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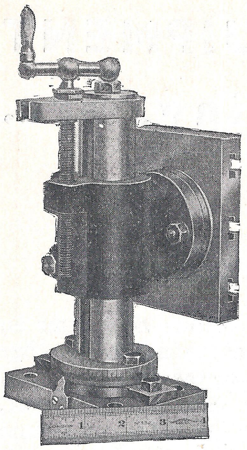

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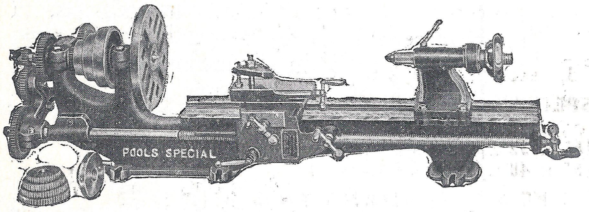

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The MODEL ENGINEER

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SMOKE RINGS

The New Year in the Workshop.

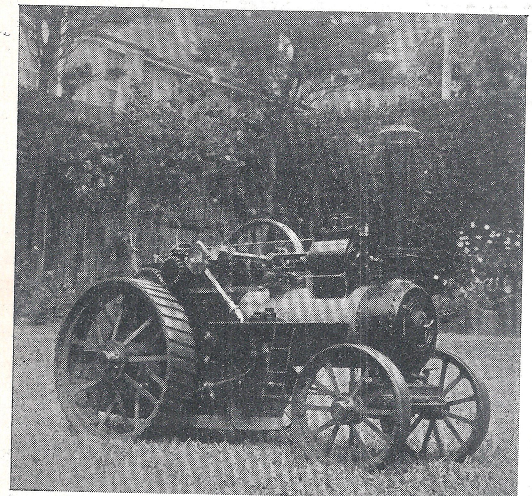
THE beginning of a New Year has a stimulating effect on most of us. We are looking out mentally through a new window, seeing new country before us. What shall we achieve during those months to come? What difficulties and trials, and what pleasures and successes do those months hold in store for us? We can eliminate some of the troubles, and add to some of the pleasures by starting the New Year well in our workshop. Is it asking too much of the enthusiast who is half-way through the building of a marvellous model, to down tools for a week or so and put his workshop in order? In most workshops there is much tidying up to be done. There is lumber and scrap to be cleared away; there are accumulated tins and boxes and oddments which can be dispensed with; there are tools to be re-ground or re-handled, and perhaps another tool rack to be put up to hold them. Perhaps there is some adjustment or re-fitting to be done to the lathe or drilling machine. There are the long-delayed improvements in the lighting to be made; perhaps there is a leak in the roof to be repaired. There is that stock of screws and bits and pieces of metal to be sorted out and placed where you can find just what you want, at the moment when you want it. Then again there is that electric motor or small engine to be installed to supply you with power to run your tools. Finally there are the drawers and boxes to be turned out, so that you may know exactly what you have got stored away, and the floor to be swept up, and the chips and shavings cleared away. I do not know if I have put my finger on any of your particular problems, but in every workshop there is something which can be done to make it more convenient, more comfortable to work in, or more efficient in its working. Why not start the New Year well, and do it now? Another New Year thought is—what are you going to make during the coming year? If you are at a loose end for a job, let me commend to your notice the launch engine which Mr. J. N. Maskelyne has designed for the plate presented with this issue. It is a design which can be built for a show model, or for doing some real work in a boat. It is not too difficult to build, and will not take too many months to complete. It will give you plenty of nice machining and fitting jobs, and does not require a very elaborate degree of workshop equipment. I shall hope to see some models built from this design at our next exhibition. Having endeavoured to stimulate your conscience as to the New Year problems in your own workshop, I am wondering if you will turn round on me and say—what about the New Year in the Editorial office? Let me say right away that my conscience is at work also, and I am planning to make 1936 a better "M.E." year than ever. I do not imagine that I shall please all my readers all the time; there is always somebody who wants more of this or less of that. But I think I can safely say that we shall not fall below the standard we have set in recent years, and in some respects I hope to improve upon it. It will interest you to know that Mr. J. N. Maskelyne has joined our permanent staff, and, as is indicated by his work in the current issue, will bring fresh ideas to bear on the questions of what to make and how to make it. All our other regular contributors will continue their special features, and while we cannot respond to all the requests we receive for articles and designs on specific subjects, I shall, in general, do my best to see that the wishes of my readers are reflected in our

contents. The New Year is here; let me express the hope that it will be a happy one for you. May it bring you good health, prosperous employment, and the successful achievement of your model engineering desires

* * *

The "M.E." Traction Engine.

I AM always pleased when I know that any design we have published has been successfully carried out by one or more of my readers. Here is a photograph showing the excellent completion of a model traction



The "M.E." Traction Engine, by R. P. Brown.

engine, built to the design we presented with our issue of January 5th, 1933. This has been constructed by Mr. R. P. Brown, of Hove, who writes :—"I thought that perhaps you would be interested to hear that I have built the 'M.E.' 1 in. scale traction engine, which is a complete success, and certainly a credit to Mr. H. Greenly, the designer. Steam is raised from all cold in four minutes. using charcoal soaked in methylated spirit, the boiler generating more steam than the engine can use. It is impossible to keep the safety valves from blowing off, even with the feed pump on all the time. The engine runs perfectly both ways, and notches up in the correct manner; it is so powerful that I shall build a ball-bearing car soon, as I am confident it is capable of pulling me. The model was a pleasure to build, thanks to the drawings and instructions in the 'M.E.,' as well as the excellent blue prints. I think Mr. Greenly has achieved good results in the difficult task of combining a working model with one that is very near to the full-size prototype, especially taking into consideration the small scale." My congratulations to Mr. Brown on the success he has achieved with this design. The pleasure he has experienced in the building, will, I am sure be equalled by his enjoyment of the running of this fine model. If any other readers wish to emulate his success, they may obtain a full set of blue prints from our publishing department, post free for 7s. 10d.

* * *

Model Power Boating in Brussels.

I AM interested to hear from my old friend Mr. J. Van Leemput, of Antwerp, that a new model boating club has been established in Brussels under the title of the "Modele Yacht Club de Bruxelles." This new club caters for both sailing and power boat enthusiasts, and has already enrolled forty members. I hope that in the future we may look to Brussels to supply some new element of competition in the annual speed boat regattas organised by the M.P.B.A.

* * *

The Finchley Exhibition.

I HEAR from Mr. S. C. Pritchard, Secretary of the Finchley Model Engineers' Society, that the proposed exhibition, previously announced for early January, has been postponed. Any fresh arrangements which may be made will be announced in due course.

* * *

The Physical Society's Exhibition.

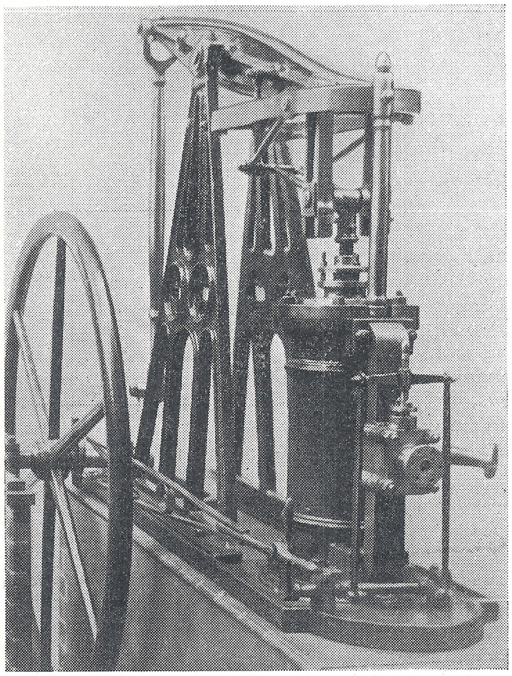
THE Twenty-sixth Annual Exhibition of scientific instruments and apparatus arranged by the Physical Society, will be held on January 7th, 8th and 9th, 1936, at the Imperial College of Science and Technology, South Kensington S.W.7. The leading manufacturers of scientific instruments will be exhibiting their latest products in the Trade Section. The Research and Experimental Section will contain contributions from research laboratories, and there will be a special sub-section devoted to experiments of educational interest. In addition, the work submitted for the Craftsmanship and Draughtsmanship Competition by apprentices and learners will be on view. Admission to the exhibition is by ticket only. Members of Institutions and Scientific Societies may obtain tickets from their Secretaries; tickets may also be obtained direct from the Exhibition Secretary, 1, Lowther Gardens, Exhibition Road S.W.7.

Percival Marshall

An Old Model Beam Engine.

By E. C. CHORLEY.

READERS of "ours," particularly those who are lovers of old-time engines, may be interested in the following description of a non-condensing "Murray" type beam engine built at least sixty years ago. This model came into my possession some months ago, in a very pathetic condition, thick with dirt, every part covered with thick black paint, even the piston and valve rods. This was really a fortunate circumstance, as it had prevented the bright



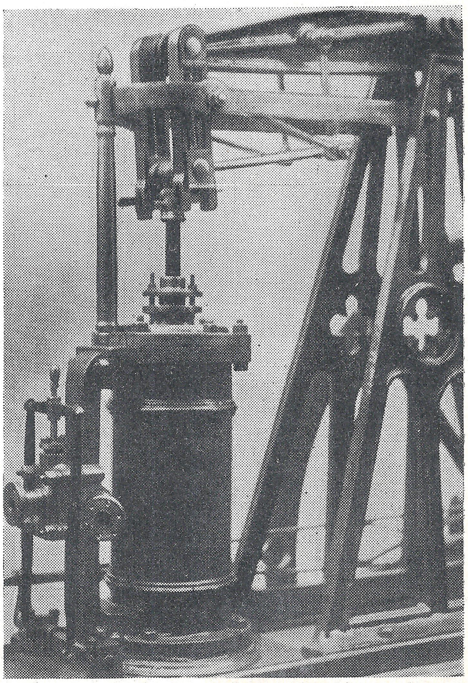
Cylinder end view of model beam-engine.

parts from rusting too badly. As the general design was good, I decided to completely restore the model, and have spent many happy hours doing this. Some new parts and alterations have been made, of which more later.

On first coming into my possession, the model was mounted on a heavy and clumsy wooden box-bed, bearing a cast-iron trade name-plate, "W. & M. Scott, Engineers & Founders, Tranmere." Inside the wooden bed was a piece of paper, yellow with age, bearing the following writing: "Model of Beam engine built by Mr. Scott, of Scott Foundry (closed down in 1876) when an apprentice. Donated (?) by his son, E. Scott." The word (apparently) donated is not very clear. I am informed that this firm built several full-size beam engines, so no doubt the builder of the model would have scale drawings available.

The principal dimensions of the model are: Bore, $2\frac{1}{2}$ in., stroke, 6 in., length of bed-plate $26\frac{1}{2}$ in. width, $6\frac{1}{4}$ in., height of A-frames to centre of beam trunnions, 17 in., length of beam (centres), 18 in., of connecting rod, $15\frac{3}{4}$ in. Width apart of A-frames, at bottom, 4 in., at top, 2 in. The design and general proportions of the model follow very closely scale drawings of a "Murray" engine in vol. I. of Stuart's "Steam Engines," 1829, and the model appears to be a 1 in. to the foot scale model of a 30 in. by 6 ft. prototype. Stuart shows the Murray valve gear on the outside of the engine, as in the model, whilst his drawings of Watt engines have the gear on the inside.

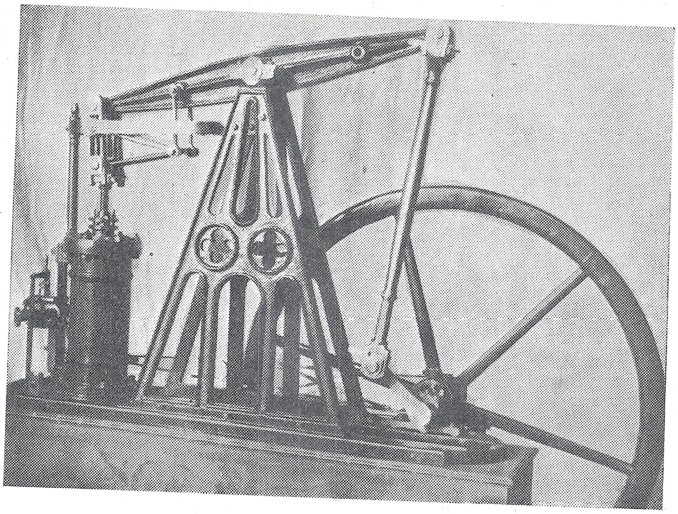
Some details of the construction may be of interest. The A-frames, also the crank-shaft bearings, have chipping-pads cast on at the base for lining-up, no doubt full-size practice. The bottom flange of the cylinder, also its seating cast on the bed-plate, are left unmachined, the joint being made with gauze-wire and red-lead putty. All bolts and nuts on the engine are made of cast-steel, each nut only fitting its particular bolt, very characteristic of the period! The flywheel mounting is interesting; the cored hole is larger in diameter than the crank-shaft, and the wheel was trued-up by folding wedges bearing on four flats on the crank-shaft, the space between the wedges being filled with lead. As the wheel runs reasonably truly, I did not disturb it. The wheel itself is of conventional type, not machined, oval-section rim, and six straight arms. The crank-shaft is circular, reduced in diameter where it runs in the bearings. The prototype would have a square cast-iron crank-shaft, and square cored holes in the wheel and crank, these being trued by wedges. In the model, the



A close-up of cylinder and parallel motion.

crank is keyed on to the circular shaft.

All the parallel-motion was refitted, also the valve-gear. The original stuffing-boxes on the piston and valve-rods were of the screw-down type. These were replaced with studded glands. The original eccentric-rod was a simple plain round rod; this was replaced with one of conventional lattice form, retaining the old straps and gab-end, the lattice being built on to these. The connecting-rod, whilst well forged, had plain eyes at the ends, not even bushed, which was rather remarkable, considering the good work the builder had put into the rest of the job. Perhaps he left the connecting-rod until the last, and then became anxious to see the engine run! I cut these plain eyes off, and fitted the rod with straps and brasses, with gibs and cottars at the yoke end, and old-type cottar-adjusted bearing at the bottom end. These can be seen in the photograph, and represent quite a lot of work.



Side view of model beam engine.

New pins top and bottom had also to be made.

Other work on the model included the replacing of several screws with studs and nuts, flanges for the steam connections, instead of the original huge unions, and generally lining-up the motion. The unmachined cast-iron parts were painted the original shade of green, traces of which could be seen when cleaning off the black paint. Any raised ribs were lined in black, which looks quite effective. A new wooden box-bed, with an extension to take the outside crank-shaft bearing, was made, and painted to represent masonry. No pump was, or is yet fitted, although there is a boss cast on the beam for pump drive.

Despite its comparatively large size, the model can be blown round, only about three revs. with one deep breath, it is true, but it can be done! As it seems to be a criterion of efficiency for a model to be blown round, I mention this!

Damping Electric Motor Vibrations.

By J. A. BUTLER.

THERE must be a number of users of small electric motors, for workshop driving, who find that the vibration occasioned by even the best machines, becomes irksome after a time. It is hoped that the following methods of lessening this nuisance—which have been successfully tried out by the writer—may be found of assistance to people who, like himself, are sensitive to vibration.

Firstly, the actual mounting of the motor must be considered. Provided it can be placed upright, either on the floor or on a stand, pieces of sponge rubber cut a little larger all round than the motor feet, are placed between these and the surface it is to stand upon.

Coach screws, considerably smaller in diameter than the width of the holes or slots in the feet, are used for fixing, and holes are bored in the rubber sponge pads to take these. A red-hot wire was used for boring. Thick rubber washers are placed under the heads of the screws, and short lengths of rubber tube slipped on below the washers. The rubber tube is of such thickness that it will just allow the screws to be pushed through the fixing slots of the motor, and cut in lengths just shorter than the depth of the motor feet.

The motor is now screwed down, care being taken that only a light pressure is applied by the screws, so that the motor feels "flexible" on its mounting. This flexibility does not interfere with the working of a belt drive.

The result of the foregoing is to insulate the motor completely from rigid contact with its surroundings, but a certain amount of vibration is of course transmitted through the rubber. The effect of this can be minimised, if the motor is mounted on the floor direct, by arranging the layout so that the floor boards do not run from motor to bench, but crossways.

The electricity supply authorities gave their consent to the installation being carried out as described, but said that care should be taken to keep oil from the bearings from touching the rubber, by wiping down the end plates now and again. Had the motor been larger (the one in question is of ¼ h.p. continuous rating), it would appear that a sheet of "asbestine" might be required between the motor feet and the rubber pads.

A further precaution has been taken to damp down vibration in the writer's case, this taking the form of a box lined with soft material which is protected from contact with any warm part of the motor. This box, which is open at the back so as not to interfere with the wiring, and has a slot cut in one end to allow the pulley to project through, can be placed over the motor at any time if it is desired to secure specially quiet and vibrationless running.

A Model Launch-Type Engine.

A design suitable for the construction of either a working model or one for the show-case.

By J. N. MASKELYNE, A.I.Loco.E.

THE drawing reproduced as a supplement to this issue shows, full size, a design for a launch-type engine. While it follows no particular prototype exactly, or claims any special originality, the design is based on a rather fascinating little launch engine which is to be seen in the Science Museum, South Kensington. The main object of the drawing is to enable a model maker to construct a model which should be pleasing to look at, not too difficult or costly to build, but, at the same time, to incorporate a few features which would add interest to the construction of such an engine, and call for a certain amount of skill in the use of tools and other workshop equipment.

The engine has two cylinders, each $\frac{3}{4}''$ dia. and $\frac{3}{4}''$ stroke, mounted on a plate fixed to the top of the standards. The lower ends of the standards are, of course, bolted to the bedplate. Two sets of Stephenson link motion are included; the steam-chests are arranged one at each end of the engine, and a reversing lever is arranged at one end. The vibrating links are of "launch" type, suspended at what may be termed their outer ends. The advantage of this type of link is that the "throw" of the eccentrics may be made equal to half the valve travel, thus avoiding the somewhat troublesome necessity for ascertaining the proper eccentric throw that results from using "locomotive" type links. Another point to be noted in favour of the "launch" type link is that it permits the use of relatively short-throw eccentrics and short rods. On the other hand, its use is apt to cause rather excessive slip of the die in the slot, unless the eccentric-rod pins are fitted as close as possible to the slot.

The crankshaft is designed to be of the built-up type, with back extensions to the webs to act as balance weights. This type of crankshaft is usual on all marine engines, as it forms a ready means of balancing the reciprocating masses, the size and mass of web-extension required being fairly easily calculated.

The standards and bedplate may be either castings or built-up out of plate, according to the ideas, skill and facilities of the builder.

Cylinder castings which would suit an engine of this type are obtainable commercially; but there is no reason why the model maker should not design his own if he chooses to do so. In a later article, a dimensioned drawing of a suitable cylinder will be given.

Marine-type connecting-rods are recommended because they are appropriate to the design, interesting to build, and good to look at when they are finished. The engine offers a certain amount of opportunity to those who like to indulge in "finish." For example, the cylinders may be lagged with planished steel plate bound by nickel-chrome or silver steel lagging bands; or they may be lagged with small strips of wood or other material finished to represent the mahogany lagging which is so often seen, and looks so well, on engines of this type. The link motion and reversing lever should be left bright, to give that "well-cared-for" appearance so beloved by marine engineers, especially in the case of steam engines.

The next instalment of this article will commence a fuller description of the various details, with some suggestions for their manufacture. In the meantime, with the aid of the drawing and the foregoing remarks, readers may care to study the design and make preparations for commencing the construction of the model.

(*To be continued.*)

For the Bookshelf.

The "Practical Engineer" Mechanical Pocket Book and Diary, 1936. (London: Oxford University Press.) Price 2/6, or in leather cloth, 3/-, postage 3d.

The most notable additions and alterations to the latest edition of this popular Pocket Book are in the section relating to Steam Generators, which deals with both water tube and fire tube boilers, economisers, feed water heaters, etc., but many other sections have been revised and brought up to date, embodying new British Standards Specifications, and results of the latest research and development.

The Book of Speed (Second Edition). (London: B. T. Batsford, Ltd.) Price 5s., postage 6d.

The first original edition of this book, published just over a year ago, proved to be so popular that a new and up-to-date issue has been published, in which the latest achievements in all branches of speed are summarised in a chapter by Mr. Barré Lyndon, under the title "The Pace in 1935." Further illustrations have also been added, which make the value of the book still greater, with no increase in price.

Coal, Power and Smoke.

Abstract of the Presidential Address to the Junior Institution of Engineers by Sir Frank Edward Smith, K.C.B., C.B.E., D.Sc., LL.D., Sec.R.S., delivered at the Inaugural Meeting held at the Royal Society of Arts on Friday, the 13th December, 1935.

WHILE space does not permit the reproduction in full of Sir Frank Smith's most informative address, we have made some extracts which we think will be perused with great interest by our readers.

After giving the points of view of the miner and the mine-owner, Sir Frank said :—

The Engineer's View.

" The engineer looks at his contribution to the coal picture with a certain amount of pride. In the mine, each pound of coal is the equivalent of about 14,000 British thermal units, or 11 million foot-pounds of latent energy, sufficient to raise 31 tons of water from the bottom of Niagara Falls to the top ; or, to give another example, 15 lb. of coal contains sufficient latent energy to raise the 73,000 tons of that great ship 'The Queen Mary' 1 ft. Indeed, coal is energy in a very concentrated form, and it is of interest to note that when energy has to be transferred over long distances the cheapest form of transmission in this country is in the form of coal in trucks on the roads, on the railway and in ships. The engineer looking at coal, realises that, as an industrial country, we must use our coal efficiently, whether it be for steam-raising, for gas-making, or for the manufacture of motor spirit, and the thermal balance sheets prepared by him are a continual incentive to make processes more and more efficient. It has been calculated that, of the energy latent in coal as it lies in the mine, something between 2 per cent. and 60 per cent. may be expended in various processes of treatment, preceding the use of the fuel in its big transformation into kinetic energy as high pressure steam, or high pressure products of combustion in the internal combustion engine. It is stated that petrol may be obtained from coal with a thermal efficiency of 40 per cent., but in the internal combustion engine using petrol derived from coal, the loss of energy in all the processes from coal to work is nearly 90 per cent. The engineer looks with pride on that part of the picture representing energy from coal ; he has done much to increase the efficiency of converting the latent energy of coal into useful kinetic energy. Such figures as the following may appear sad reading to the coal producer, but to the engineer they mean avoidance of waste.

Weight of coal needed for production of 1 million units of electricity :

1923	1,083 tons.
1934	661 ,,

The Man-in-the-Street's View.

The man-in-the-street, looking at the picture of coal through his glasses, is well pleased to see that we have in this country not less than 100 thousand million tons of coal in many and good varieties. The export of tens of millions of tons every year pleases him, for it enables him to pay for some of the food he must import in order to live, but a fall in that export trade of over 30 million tons, and a fall of nearly 10 million tons in foreign bunkers, naturally causes him much concern. He sees that other countries are buying less coal from us and developing their own coal resources, and he knows that the entry of British coal into foreign countries has been hindered by discriminating tariffs, subsidies, quotas, currency problems and other restrictions to trade. He sees that in 1910 Russia produced about 23 million tons of coal, while last year she produced 93½ million tons, and this was 18 per cent. better than the production in 1933. Poland before the war produced about 5 million tons of indifferent quality coal ; last year she produced nearly 29 million tons of much better coal, and of this she exported 10 million tons, the Polish State railways carrying this exported coal 400 miles for about 3s. 6d. per ton. Recent trade agreements with the Scandinavian countries have been valuable, but they have had the effect of diverting some of the Polish and German exported coal to the South, and thereby increasing the competition with British coals in the Mediterranean countries.

While he would much prefer to see the motor car run on coal instead of imported oil, he fully realises that without oil there would have been no motor car. At first he is inclined to look at our imports of oil with very grave concern, for whereas, when King George came to the throne, we imported 345 million gallons of oil, last year the imports were 2,751 million gallons —an increase of eight times in twenty-five years. These figures show that this country, which for many years produced at home all that was necessary for meeting its power requirements, was in 1934, importing power in the form of oil equivalent, on a heat basis to 12 million tons of coal and the quantity imported is increasing. However, being unbiased, the man-in-the-street listens to his oil friend, who tells him that while the 12 million tons of coal would have needed about 43,000 men to win it from the mine, the motor car industry employs, directly and indirectly, more than one million persons, and incidentally, Sir John Cadman has estimated that for every ton of motor spirit used here, one ton of coal is used for the purposes of motor vehicles and the motor industry."

After discussing the scientist's view, and the question of fuel survey, Sir Frank went on to deal with :—

The feat of the engineer in converting the latent energy of coal into electrical energy is very striking, but only part of the increased economy is due to the increased efficiency in burning coal. Always must it be remembered

that the engineer, and particularly the electrical engineer, is dealing with an exact science. The precise measurement of all the heat quantities involved, and an intimate knowledge of the properties of steam at moderate and high pressures, enables him not only to calculate the losses of energy, but often to reduce their magnitude. The heat needed to raise water to the boiling point is, in general, difficult to recover, but the heat given to the steam is not, and so in recent years more and more heat has been given to steam, and pressures have risen from 200 lb. per sq. in. in 1910 to 1,200 or even 1,500 lb. to-day. The engineer realised that increase in the size of both boiler unit and prime mover should lead to increase in efficiency, and whereas in 1910 the maximum output from a Lancashire boiler was about 10,000 lb. of steam per hour, and from a water tube boiler 20,000 lb. per hour, with efficiencies of about 65 per cent., the unit size of water tube boiler to-day has a capacity of over one million pounds per hour and an efficiency of 90 per cent. There have been considerable changes also in the design of furnaces, and lump coal is being rapidly replaced by powdered fuel. Investigation of the principles of combustion, increased knowledge of fuels, a greater appreciation of the fusion temperatures of ash, and a study of the heat absorption of furnaces, have led to a very considerable increase in the size of furnaces, the height from the grate to the boiler tube having increased from about 6 ft. in 1910 to as much as 23 ft. to-day. In addition, the rate at which fuel can be burnt per square foot has doubled. As regards boilers, riveted boiler drums are giving place to seamless drums as much as 45 ft. in length by 4 ft. internal diameter, forged from ingots weighing as much as 150 tons. By the use of special steels, such as nickel-chrome-molybdenum steel, the wall thickness of the drums has been reduced to half the thickness necessary with medium carbon steel, and drums made by metallic-arc fusion welding are being developed. Flash welding is also being used for joining tubes together to form lengths of 150 ft. which are then bent for multi-loop elements for modern superheaters and economisers. Few new forms of boilers have been introduced, but much greater attention is being paid to the purity of water, and a practically new industry has been developed for the manufacture of apparatus for purifying feed water.

But the factor contributing most to the progress which has been made was the development of the Parsons steam turbine. There is, indeed, no greater epic in the whole history of mechanical engineering than this. Sir Charles Parsons, even in his original patents, and when he first committed his ideas to paper in 1884, seems to have foreseen practically every important development which has since occurred, and he saw many of them come to fruition before he died. At the time he drew up those patents, no practical success whatsoever had been achieved by following the idea of deriving energy from the velocity of expanding steam rather than from its pressure. The underlying idea of the arrangements described in them was the avoiding of excessive and unmanageable velocity which the steam would have attained if allowed to drop to the exhaust pressure in a single expansion. They covered the principles of double flow, whereby steam is allowed to travel in opposite directions —a principle used in many of the largest installations to-day; they covered also the dividing of the machine into parts dealing with the steam in series, which is, again, a typical feature of the largest units, and is particularly important in marine woork. The patents envisaged also the development of the modern turbo-compressor, or blower, so largely used in glass furnace work.

The turbine has enabled the power which can be developed, for a given weight of machinery in a given space, to be increased a hundredfold. It has given power rotary motion at high speeds, so desirable for electrical generators, and it has combined this advantage with great steam economy. It is true to say that the turbine has played a greater part than any other invention in rendering possible the widespread distribution of electrical power.

The Effect of Ship Model Tests on Coal Consumption.

In the section of his Address relating to Shipping, Sir Frank said :—

" A further reduction has been brought about by improvements in the design of the lines of the ship's hull, brought about by what we call ' tank research ' on model hulls.

The principles upon which this type of research is based are founded on the work of an Englishman, William Froude, carried out some sixty years ago, which showed the possibility of forecasting the performance of a completed ship from tests made on small models of the hull towed at appropriate speeds through so-called tanks, really covered waterways, hundreds of feet in length. The work on models carried out in the William Froude Laboratory at the National Physical Laboratory has been thoroughly checked by comparing the results obtained there with the results obtained at sea, and it is now possible to say that the performance of a ship can, in general, be forecast with an accuracy within about 1 per cent. from the result of model tests. Last year a record number of models was tested at the William Froude Laboratory. The number of designs investigated was sixty, and it was possible to suggest improvements in fifty-four of them. It is calculated that modifications in design resulting from these tests will enable considerable economies in fuel to be brought about in the finished ships, while still preserving all the features which make for seaworthiness. Assuming that only one ship of each type is built, and that each ship steams for 250 days a year, it has been calculated, on a most conservative basis, that the changes brought about by these tests alone will have effected a saving of £25,000 on fuel costs for each year in the life of the ships.

The research work carried out at the William Froude Laboratory has led to the adoption of aerofoil propellers in cargo vessels and the introduction of the cruiser stern and the shaping

of the rudder post so as to have a fairly sharp pointed leading edge, which has generally become known as a fin. Recently, in the case of one cargo vessel, an increased efficiency of $7\frac{1}{2}$ per cent. was obtained solely by substituting a fin for a straight rudder post. But to return to our comparison. It will be seen that tank research, besides improving the general lines of the hull, has enabled more attention to be paid to the design of the ship in the neighbourhood of the propeller, so as to get the most effective flow of water towards it, and has brought about improvements in the parts of the ship which lie in the propeller race, as well as improvements in the location of the propeller in relation to those parts.

In general, it may be said that the effect of these improvements in the design of hull forms, and the various improvements in and about the propeller, has resulted in the power required to be delivered to the propeller being very appreciably reduced. There is also a small gain due to improvements in the transmission efficiency of the propelling machinery.

To these gains we must now add the contribution of the marine engineer, presented, as I have already mentioned, by greater general efficiency in engine and boiler design, the use of forced draught and higher working pressures, pre-heating from waste heat, superheating and improved feed heating, etc.

As a result of all these contributions, we can safely say that power required can be produced with a fuel consumption of 40 per cent. less than in 1913. Support of such an estimate is afforded by details of naval engineering given by Engineer Vice-Admiral Sir Harold A. Brown. In comparing a cruiser of 1935, with her predecessor of 1910, Sir Harold says:—"Fuel demands as expressed in B.Th.U. required per shaft horse-power has been reduced by 40 per cent.; machinery weight per shaft horse-power reduced by 60 per cent.; machinery space per shaft horse-power by 60 per cent.; and engine room complement per shaft horse-power reduced by 75 per cent."

Railways and Coal Consumption.

Our last extract relates to the economies in the coal consumption which have been effected on the railways. Sir Frank said:—

"In 1913, the railways of this country consumed 13,821,000 tons of coal and in 1934, 12,170,000 tons. The decline of a little over $1\frac{1}{2}$ millions tons is undoubtedly due to two causes; increased efficiency in converting coal into useful work, and decrease in trade. Since 1910, a big change in locomotive design has been brought about by the general introduction of superheating, by increasing steam pressures from 150 lb. to 300 lb., and by taking advantage of the latent heat of the exhaust steam, which is no longer allowed to escape wastefully into the atmosphere. Sir Henry Fowler states that these changes have resulted in a saving of fuel of from 20 to 25 per cent. of the previous consumption (1910), whilst, in addition, there is about an equivalent saving of water. Such savings have allowed engines of the same weight being built so as to give increased capacity and power. The lower estimate of saving (i.e., 20 per cent.) given by Sir Henry Fowler is equivalent to 3 million tons of coal. In his address to the Mineworkers' Federation of Great Britain, Mr. Joseph Jones, the President, said that 'in 1919 the freight services on the American steam railroads used 170 lb. of coal per 1,000 gross ton-miles. By 1931, the figure had been reduced to 119 lb.' This is a reduction of 30 per cent. in the period 1919–31."

In the concluding portion of his address, Sir Frank dealt with the gas and iron and steel industries, and the question of smoke prevention. His last final words were:—

"It is well to remember that the motor industry, the aircraft industry, the rayon industry, the radio industry, the artificial nitrates industry, and the hydrogenation of coal, are all new in our own lifetime—at least they are in mine—and they employ well over a million workers. Why not be optimistic and see, in the picture of coal's future, the use of de-ashed pulverised coal in internal combustion engines, and new industries that science will produce with coal as the raw material? and one can but hope that at least some of these new industries will find a home in the present depressed areas, and that with such alternative occupation, the shadow of unemployment will gradually disappear."

Royal Air Force Vacancies.

The Air Ministry announces that 300 vacancies will occur in February next for Boy Entrants for training as wireless operators, armourers and photographers in the Royal Air Force. Particulars can be obtained from the Air Ministry (Boy Entrants' Dept.), London, W.C.2.

The number of vacancies includes the increases necessitated by the expansion scheme which is now in progress.

Entry will be open to boys who are between $15\frac{3}{4}$ and $17\frac{1}{4}$ on the 1st February, 1936, and who have attended a secondary, junior technical or central school up to the age of $15\frac{1}{2}$, or have attained an equivalent educational standard. There is no entrance examination, but candidates must be nominated by a recognised authority and present themselves for interview. Accepted boys will be given 12 to 16 months' training in the particular trade to which they are allotted.

Intending applicants can also obtain details of the scheme and application forms from their headmasters, if still at school. Those no longer at school can apply to the local Ministry of Labour advisory committee for juvenile employment, if one exists, or to the local education authority.

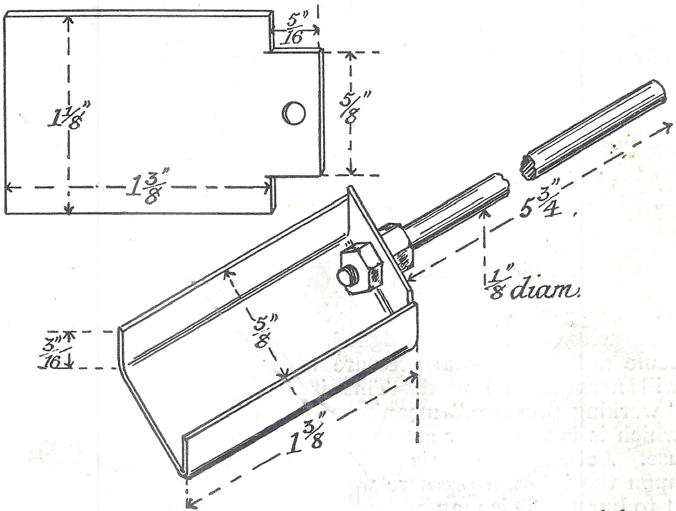
First Steps in Model Engineering.

Workshop Advice, Experience and Philosophy for Readers of all Ages.

By "INCHOMETER."

Making a Small Shovel.

An exercise in simple mechanical work for the kindergarten, making a boiler firing shovel. Though primarily intended to be used in putting coal through the firing hole of a model boiler, this shovel might prove handy as a general workshop utensil for scooping and applying borax powder and spelter used in brazing operations, also for numerous shovelling and clearing purposes. The design is not a product of my own brain, the article exists, it is the property of some model engineer; probably he has reckoned it to be lost for ever. By presenting the idea and particulars to you, I am taking a liberty, but do so with expression of thanks to the unknown rightful claimant. If he can identify his property and will let me have his name and address, with a suggestion as to the probable circumstances of the disappearance, I shall be pleased to send the shovel to him. There is a story concerning a gentleman whose umbrella disappeared one rainy evening from a social club or society in his locality. He advertised to the effect that if the person who took the article would return it, no further notice would be taken of the matter. Upon looking out of his house the next morning, he was astonished to see a dozen or more umbrellas scattered over his front garden. My case is somewhat in reverse; there is only one shovel, if a dozen letters arrive from losers of shovels, I shall need to be able to decide correctly from the information tendered. The shovel is made from sheet brass, about No. 22 gauge thickness, $\frac{1}{32}$ inch approximately. The drawing gives dimensions but, obviously, you can alter them to suit your convenience or desire. Cut a piece the shape indicated, this allows the sides and end to be bent up and form a rectangular scoop. Before you attempt the bending, anneal the metal. Heat it to dull red and then plunge it into cold water. Make a wood block, shape and size of the interior of the scoop, slightly round the edges where bending of the sides and end will be effected. Clamp this block in position on the sheet by means of a cramp or a hand vice. The sides and end may then be hammered up to give a neat shape. Notice that the end should come between the two sides. The hole to receive the handle can be drilled whilst the block is still clamped in place. It might be drilled before the bending is done, but my way would be to drill it finally; the drilling can be right through, the wood will support the drill and prevent it from catching or producing an irregular hole. The handle is a length of steel rod screwed with a fine thread, B.A. will be suitable. Notice that a thin nut is used inside the scoop. The entire affair may be enamelled any colour you please to select. It is a simple article, but gives scope for method and affords an object in practising at vice work.



A shovel for firing a model boiler, also useful for general workshop service. The upper figure shows the sheet brass ready for bending up to form.

Managing a Toy Steam Engine.

At this season, many toy steam engines are given as presents and bought to amuse children; some advice as to arrangement may be serviceable. In my article of November 22nd, 1934, I have dealt with essential considerations to be observed when one is using a steam boiler, also I have given instructions for care in firing with methylated spirit. If you have that issue available, I recommend that these two sections be read again. A toy steam engine and boiler is entertaining, and instructive if regarded seriously from a student point of view and not, similarly to a firework, merely something for spectacular effect. Firstly, and important, when working a toy steam engine and boiler of the stationary kind, have it standing upon a large iron tray. Usually the fuel employed for heating the boiler is methylated spirit; have this in a tin can, not in a glass bottle, keep it away from a fire or other naked light or source of heat, such as an electric radiator. The spirit burner or reservoir should be packed with an absorbent, say, cotton wool, the spirit should not be loose, as with oil in the reservoir of an oil lamp. Put in only enough spirit to fully soak the absorbent, do not flood the reservoir. Have the whole affair clear of paper and other Christmas decorations, enough overhead space so that if the spirit does happen to overflow ignited, you can allow it to burn out. Youngsters should stand reasonably far away, and no one should put his head over the engine and boiler whilst steam is being raised or during running. Safety valves and engine cylinder joints are liable to eject hot water.

If the engine is fitted with a slide valve, there should be a safety valve to the boiler. Many toy engines have an oscillating cylinder held by a coil spring against the steam seating. If the spring is in fair adjustment, so that you are able to pull the cylinder and compress the spring with small effort, such an engine will act as a safety valve to an extent. Before steaming, try if the cylinder is not held tightly against the steam seating. An adjustment nut is fitted to the trunnion pin around which the spring is coiled; it should be far back enough not to close the spring entirely. Cylinder and bearings will require oil. To avoid delay and consumption of spirit when raising steam, use hot water—the boiler should be about three-quarters full at starting. The boiler will not explode if all the water should be boiled away, the engine will stop running because there is no more steam, but if you do not immediately remove the burner or extinguish the flame, soldered joints will melt. Similar precautions apply to working toy steam locomotives. The risk is not really with the boiler, it is in management of loose methylated spirit. You cannot well have the railway on an iron tray, but it should be on something which will not readily catch fire, and preferably on a floor, so that the engine will not be liable to fall a distance if it should run off the rails. Keep your head back from the boiler and engine, wear a glove in case you need to take hold of some part which is hot.

Safety Valves.

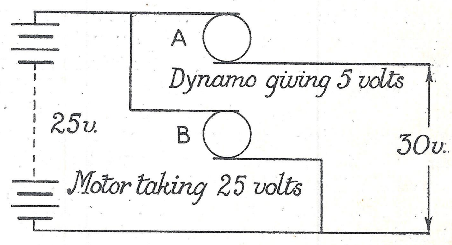
A steam boiler is designed to withstand some definite internal pressure with which it will normally be used. This is termed the "working pressure," meaning the pressure at which it is to deliver steam in regular normal use. Actually, a boiler is calculated for strength upon the internal pressure which would cause it to burst. This may be, say, from about 3 to 10 times the decided upon working pressure, according to circumstances and the views of the designer. The difference allowed between the two pressures is generally known as the "factor of safety." It is intended to cover wear, doubtfulness of strength of material, workmanship and straining which may occur during service. If you are working a boiler at a rated pressure, there will be, on this basis, margin for considerable increase of pressure, yet the boiler will not burst. This is the idea, it serves for practical purposes, though explosions of boilers occur and probably will continue to do so. With the object of ensuring that the internal steam pressure shall not rise appreciably above the declared and rated working pressure, an appliance termed a safety valve is fitted to the steam space. Its function is to open automatically with rise of pressure beyond the working rate and allow steam to flow away instead of accumulating inside. A safety valve should effect more than merely letting out a flow of steam, it should prevent any increase of pressure above the amount (pounds per square inch) at which it is designed and adjusted to open. It should permit steam to escape at the same rate that the applied heat is making steam. If the heat can generate steam at a faster rate than the valve opening permits escape, the pressure will continue to rise. With toy boilers, the safety valve is usually controlled by a coil spring. Always examine this to be sure that the adjustment nut has not been screwed up to close the spring entirely, or is screwed so far as to put too much pressure upon the valve itself. You should be able to easily pull the valve open, and to enough extent that the valve orifice is amply clear. Toy steam engines work with a low steam pressure, about 6 lbs. or so per square inch will serve well, or might be allowed up to 10 lbs. with a good class toy. Adjust the safety valve so that it blows at a low pressure, this is effected by unscrewing the nut along the valve stem. If there is no safety valve, you can find interest by making and fitting one; a drawing is given on page 8 of THE MODEL ENGINEER handbook No. 28, "Model Steam Engines," a book very suitable for use in conjunction with engines and boilers of the toy character. To ascertain the pressure obtaining in the boiler, a dead weight substitute for an indicating gauge is illustrated in the companion handbook "Model Boiler Making"; this appliance requires nicety of workmanship, it would test your skill and be very interesting, both in use and making. The term pounds per square inch means the named pressure is exerted upon each square inch of surface inside the boiler.

An Improvised Booster to Counteract Voltage Drop.

By A. O. GRIFFITHS.

I once had the problem of supplying temporarily, some 25 volt lamps at a distance of a quarter of a mile from a storage battery. The lines were in existence, but they were so small that there would be a 5 volt drop, which was, of course, far too great. What was to be done?

I had two dynamos, both enough amperage, and both 50 volt machines, but no engine.



What was done was to use one as a booster, carrying the whole current, and drive it with the other as motor, the second machine taking its power from the battery.

Another way would be to couple A across lights, generating 30 volts, but if the belt came off, the lights would go out. The method shown would only mean a drop of 5 volts if the belt came off.

A Simple Collet Chuck.

By F. HALL BRAMLEY.

FOR very small work which needs great accuracy, the three jaw chuck is not altogether satisfactory. Thus, if we have an accurate round rod, true to diameter, and wish to turn a pivot with a shoulder at the end, as shown in Fig. 1, few three jaw chucks will enable us to make the small diameter A truly concentric with the full diameter B, and some of these little spindles require reducing at both ends.

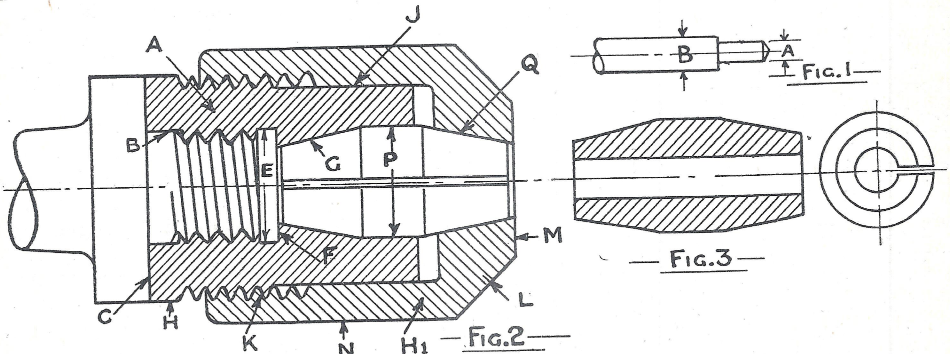
Turning them between centres is out of the question, since there is hardly room for centre holes. The chuck shown in Figs. 2 and 3 is designed to give the accuracy necessary for this small work. It has the advantage that it closes up on the stock equally at the front, back and the whole length.

The body A is turned out of mild steel bar and fits the lathe mandrel nose. It should be an exact fit at B and bed up flat against the mandrel collar at C.

should be as far back as indicated by the drawing, in order to get as long a parallel part at J as possible to carry the sleeve H1.

The sleeve should then be turned out of a piece of Bessemer bar. It should be chucked in the three jaw chuck, and bored out to a close fit on the outside diameter of the chuck member at J, so that it will just slide along without shake, and the inside screw thread at K should be turned inside it to fit on the outside thread of the body A.

A short mandrel should be chucked in the three jaw chuck and turned to take the piece the other way round, tightly driven on to it, and the outside of the piece should then be turned, chamfered and faced at L. and M. Then the end should be bored out and the cone mouth turned by an inside tool to the same angle as the coned end of the bore of the body inside at G.



Details of simple Collet Chuck.

It should be chucked in the three jaw chuck by the outer end and bored out to a length equal to the length of the mandrel nose, and to a diameter equal to the bottom diameter of the thread. Then the clearance at B should be carefully bored out to exactly fit the plain part of the mandrel nose, and for a little further distance along, so that there is no risk of it binding on the thread before it beds up flat against the shoulder C on the mandrel nose. Then the internal screw thread is turned. The clearance at E should be turned out with a square nosed inside tool, so that the face F does not touch the end of the mandrel. It should be at least a sixteenth of an inch away.

The piece should then be taken out of the chuck, the chuck removed, and the prepared piece screwed on in its place. Then a hole $\frac{1}{8}$ in. in diameter should be drilled through to F, feeding the drill up with the back poppet barrel or centre. Then the hole should be enlarged, and a taper should be turned back at G and then parallel at P. The outside end should be faced off, and the outside diameter turned back parallel, leaving the diameter at H high enough

The outside of the sleeve at N may be knurled or otherwise roughened to get a grip for tightening the chuck on the work, or it may have a couple of holes $\frac{1}{4}$ in. in diameter (or a little smaller) to take a pin spanner to turn the sleeve.

The collet for holding the work is as shown in Fig. 3. It is a simple piece of cast steel rod of the diameter P Fig. 2, i.e., the diameter of the inside of the chuck body. The ends are turned to the angles to correspond to the angles in the end of the body at G, and the angle in the end of the sleeve at Q, and it is bored out with a central hole and slotted along into the bore, so that, when the sleeve is screwed along, it can contract the collet on to the stock or piece and hold it with equal force all along and parallel.

For gripping different diameters of work, brass rod may be chucked in the collet, bored out to the diameter to take the job and slotted. Then the chuck will hold all tight, and eventually a stock of these brass sleeves will be accumulated to take almost any small piece required to be accurately turned at each end, true with its central body.

SHOPS SHED & ROAD

A Column of "Live Steam."

By " L. B. S. C. "

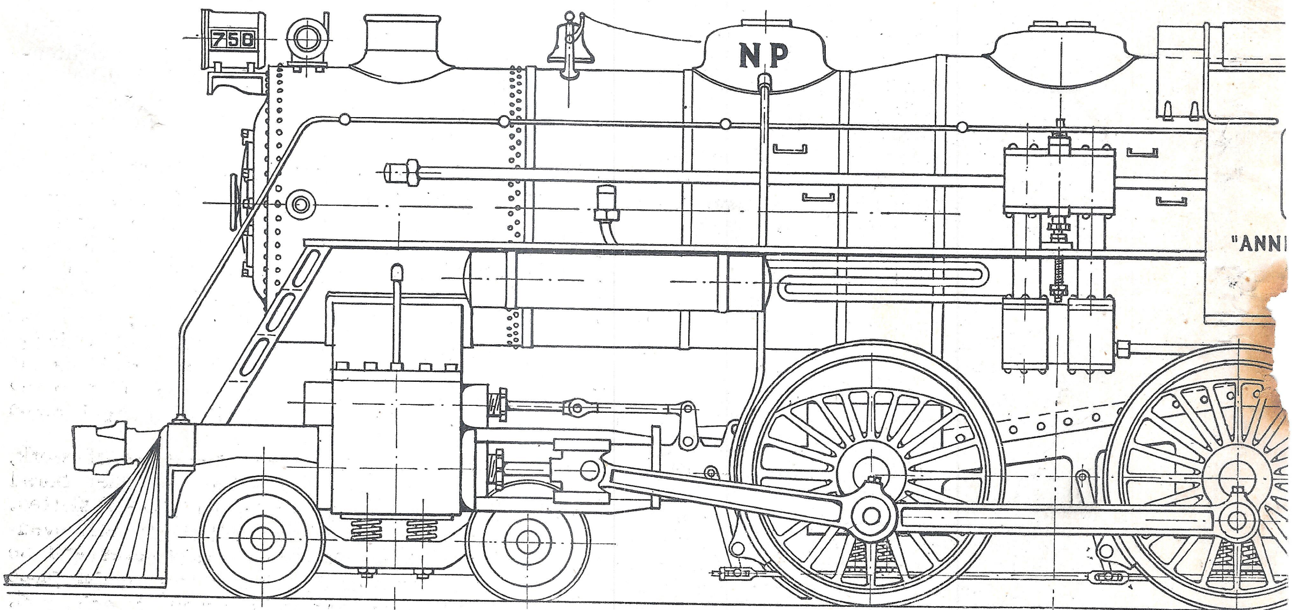
"Annie Boddie," Sez She!

Well, brothers, what do you think of our little "Annie," now she has been over the pond and got naturalised? Isn't she just a peach—eight-wheel tender with booster and all complete, and all the rest of the latest American fashions! Personally, I'm tickled to death with the appearance of our own little lady in this rig-out; I'm not responsible for the drawing, though, and you'll hardly believe it, but I haven't the foggiest notion who on earth is! A few days ago I was clearing out an accumulation of correspondence, books, papers, drawings and what-have-you, when I came across a big envelope with some drawings in it. The envelope was sent by post, direct to me, many moons ago, and it contained no indication as to whence it came. A few words relating to one of the drawings, that of a Midland single-wheeler, were pencilled in one of the corners, and I compared these with some of my correspondence. There were five or six brothers whose caligraphy was very similar to the words, and I wrote to each of them in turn to thank them for the drawings; but every one disclaimed all knowledge of them. I therefore put the envelope away, in the hopes that " Brother Nobody " would in course of time reveal himself, and promptly forgot all about the drawings in the eternal struggle for a daily crust, until they came to light again as mentioned above. Well, Bro. Nobody, old pony, I'm not going to try to seek you out, if you have no wish to reveal your identity; but I'm going to thank you for the drawings, compliment you on your skill, and endeavour to make use of the clever way in which you have dolled up little "Annie" into a N.P. "frail," by describing briefly how she can be built to your idea.

Some Difference!

Bro. Nobody has kept to the original British dimensions as far as works are concerned, by all appearances. The sizes of the leading truck wheels, coupled wheels, and lengths of bogie and coupled wheel-base are the same as on the original "Annie," but the bogie wheels are of the solid disc type. Cylinders and valve gear are also the same; but after that he has to break away. Bar frames replace British " Annie's " plates; and the little L.M.S. boiler is quite a small affair beside American "Annie's" massive wagon-top generator. A typical American cab is shown, also the high running boards bracketed to the boiler. All the transatlantic blobs and gadgets are well in evidence, including pilot, central couplers, bell and headlight, sand dome, working brakes, and a duplex donkey pump of a type described in the Live Steam notes on donkey pumps in general. This particular one has the cylinders back to back, with the valves in a common steam chest, the trip rods being operated by a finger attached to the piston rod of the opposite cylinder. The pump delivers through a feed water heater which can easily be made to work.

British " Annie's " L.M.S. tender has been



Drawn by]

How "Annie" came back

completely superseded by a regular U.S.A. eight-wheeler, the leading truck of which is arranged for booster operation, the wheels being coupled. The trucks are a cross between those used on "Fayette," and the Toonerville R.R. trucks; they are easy to make. Solid disc wheels are used. No brake gear is shown on the tender. Although the engine is just a simple 4-4-0, she would be far larger and more powerful than any engine of similar type in this country, and here are a few details of how to build a sister.

Frames and Running Gear.

Although the American locomotive builders have long since ceased making up frames from bars (hence the title "bar frames") the shape of the bar frame still obtains, although usually cast. There are no small cast frames available for American "Annie," so unless you like to make a wood pattern and get a couple specially cast, they will have to cut from the solid. By rights they should be 1/4" in thickness; but if you don't relish the idea of chopping them out of this thickness, use 3/16", which will be plenty strong enough. As the shape of the complete frame is not easily picked out from Bro. Nobody's general arrangement, I have included a sketch of it separately. The pilot beam can be a casting; Kennion has American type 2½" gauge pilot beam castings in stock, as used for the "President Washington" engine. If built-up construction is preferred, use a 5" length of 1/2" by 3/8" steel bar (shades of Bill Massive!) and either attach by angles, or braze up solid. The rear or drag beam under the cab can be made the same, or a casting used there as well.

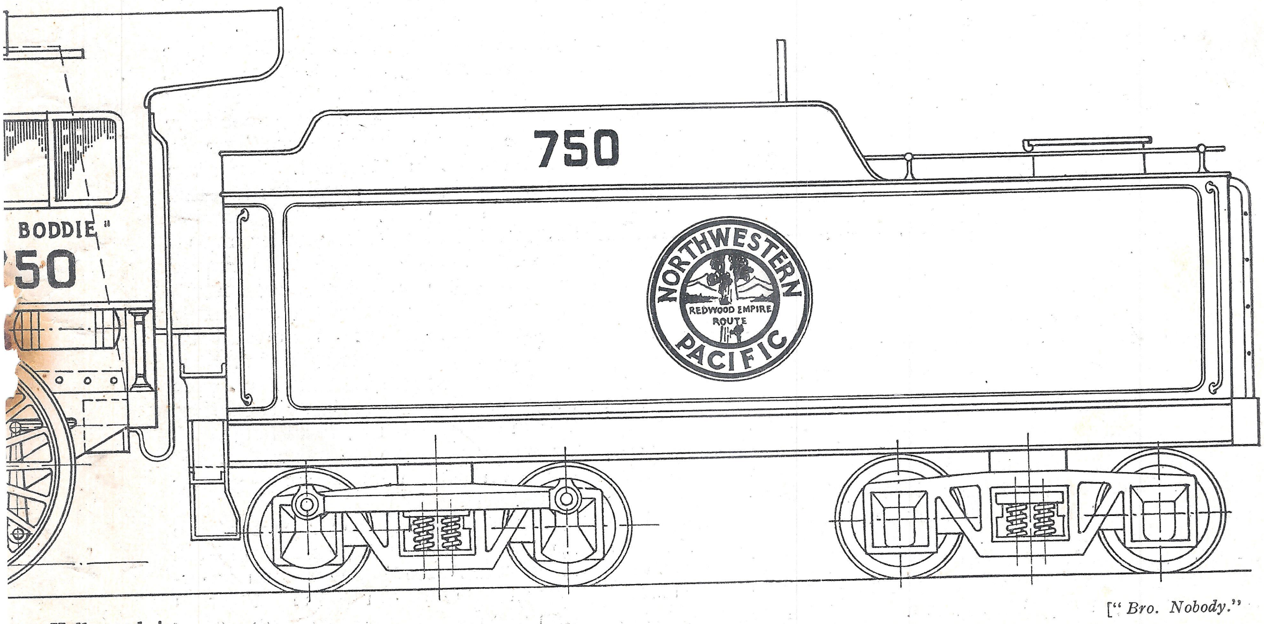
No horn blocks are required, the thickness of the frames providing ample bearing surface for the axleboxes to work against. The axleboxes are single flanged, same as "Fayette's," whilst the hornstays ("pedestal ties" is their proper title) are strips of 1/8" by 1/4" steel, screwed across the bottom of the horn slots. Springs and pins are the same as on British "Annie."

The leading bogie can be built up as on British "Annie," except that 3/16" steel should be used for side frames. Alternatively, a cast bogie centre ("leading truck" is correct for American practice) as sold for "President Washington" can be used, and the wheels should be of the solid disc pattern; "Fayette" tender wheels, although a little smaller than those shown, are quite O.K. for this job. Axles are 5/16" diam., and distance between flange backs 2 9/32" as usual. The driving wheels are 3 9/16" diam., and the crankpins set at 9/16" from centre, for 1⅛" piston stroke; but the driving pin should be 5/16" diam., and the trailing pin 1/4". The coupled axles can be kept at 3/8" diam., as on British "Annie," but if you want to go the whole hog, make them 1/2".

Cylinders and Motion.

The same cylinder castings can be used as on British "Annie." *Bore them out as big as ever the castings will allow*—never mind about all the tales you hear! American "Annie" will be about twice the weight of her British sister, and she'll not only hold the road, but as she gets away off the mark you can "widen out," as the American enginemen say, and keep the acceleration at a high rate; thus obtaining bursts of speed even on a short track. Machine and fit the cylinders exactly as described for British "Annie," and bolt them to the frames in the same way. Most American engines have the cylinders and smokebox saddle cast either in two halves, or as one unit; in some cases they have main frames and cylinders entirely in one casting, calling it an "engine bed"; but it would puzzle the average small loco. builder to machine up such a casting with the outfit usually found in amateur workshops, so it wouldn't be much use getting such a casting put on the market.

British "Annie's" guide bars can be used.



rom Hollywood. ! [" *Bro. Nobody.*"

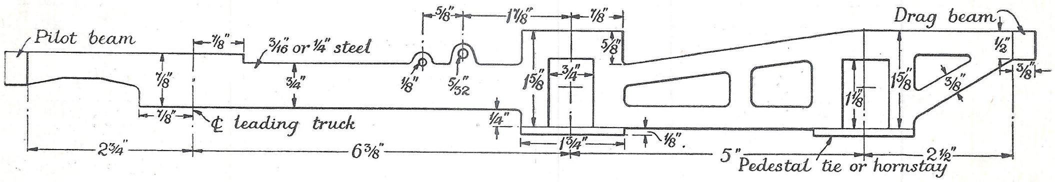
The guide yokes are not bolted to the frame, but are attached to a bar which extends right across the top of the main frames and is screwed to them. This bar could be made from a straight piece of ¼″ square steel, slotted at each end; the yokes being fitted into the slots and brazed. The crossheads are of the usual pattern, but the connecting and coupling rods (main and side rods in U.S.A. nomenclature—gee, that sounds swell!) are very much "Bill Massive." The circular big end simulates the floating bush type, now frequently used in full-size practice where pressure grease lubrication is employed.

The valve gear can either be loose eccentrics or Stephenson link. Most of the older 4-4-0 engines had link motion, but there is none of this type built to-day. Baker gear would be very suitable for American "Annie"; and if this is preferred, an extended guide yoke could be arranged to take the bracket type gear frame. In the short space available, there is no room to go into details of that right now; but if anybody wants the "complete lowdown" on it, I'll dope it out as opportunity arises, and include it in a future note. With either of the eccentric-driven gears, a rocking shaft is used as shown in sketch; the inner arm hangs down and the rod of the loose eccentric is coupled direct to it, or else a link motion (same as "Maisie's" only smaller) used, the die blocks working directly on the pin in the rocker arm. A single boiler feed pump, about 5/16″ bore and 7/16″ stroke, could be fitted between the frames ahead of the rocking shafts; or a couple of smaller ones could be installed as an alternative, and driven off extensions of the rocking shafts, thus doing away with the need of extra eccentrics. A mechanical lubricator should be fitted ahead of the cylinders and close to the smokebox saddle; the ratchet lever of this could also be driven from the rocking shaft. Great pains should be taken to make the motion work between the frames neat and tidy; the boiler being high pitched, and the absence of frame level running boards, shows it up pretty well.

Boiler.

This will certainly please the advocates of the "barn" firebox, because the firebox casing is longer than the barrel! The explanation is that in general, American steam coal isn't as full of "therms" as the British kind, and consequently they need a bigger fire to get the heat. Any-old-how, the rawest knight of the shovel shouldn't have any difficulty in keeping American "Annie" on the pin, even with domestic kitchen cobbles. The barrel is only 5½″ long, but it is 3¾″ diam., and the final 1¼″ of it nearest the firebox is flanged outwards to form a "wagon top" extension. This can be easily done by softening the tube forming the barrel, laying it over a piece of stout bar, say about 2″ diam., held in the vice, and judiciously biffing with a hammer, that part you want to enlarge. Our old friend down at Mousehole might probably care to chip in here, and explain in full how this is best accomplished. The vertical diameter, after the coning is completed, should be 4″.

The firebox wrapper has a sloping back, is 6″ long at the top, and 6½″ long at the bottom, almost touching the drag beam. It sits in the angle behind the driving axleboxes, resting on top of the frames, and is 2⅛″ wide at the foundation or mud ring. Connection between barrel and wrapper is made by a narrow butt strip, held in position by a few small rivets, and then brazed up solid. The inside firebox extends down about ¼″ below the top of the frames, and is as wide as the frames will allow, the water space being equal to thickness of frames, either 3/16″ or ¼″ as the case may be. Allow ¼″ back and front. The upper part of the firebox is swelled out in the usual manner, and owing to the large diameter of the barrel, there is room for about sixteen ⅜″ tubes and a couple of ¾″ superheater flues. This tube area, combined with the sharp exhaust from the big cylinders, will enable sufficient draught to be maintained, to work the long firebox to its full



Main Frames for American "Annie."

capacity if occasion should arise; normally, the fire will just burn dull red in a desultory don't-care-a-bean kind of manner, whilst making plenty of steam for properly-timed and fitted cylinders—a different state of affairs altogether to engines which just *have* to have a huge firebox to make any show at all.

The smokebox is 3½″ long, and could be made from brass or steel tube, say 16 gauge. It is attached to the boiler by a "piston-ring" joint, like the "Dyak," and the front could be a casting, with all the "ornaments" on it, turned to a push fit in the shell. American engines haven't a big smokebox door like ours, as they have ash hoppers, and soot blowers, and there is no need of any door under normal working conditions. The smokebox is carried by a cast or built-up saddle resting on the frames and fitting closely between the cylinders, which gives the same effect as the full-size "cast solid" saddle. The good old American stove pipe smoke stack can be turned up from a piece of 1⅜″ by ¼″ brass tube, or a casting, and the liner made of ¾″ tube, total length 2″. The blast nozzle wants to be set about 1¼″ below the bottom of the liner (lift pipe, our cousins call it).

Steam is taken from the upper part of the "wagon-top" by a pin throttle with pull-out handle, and the "Fayette" type of twin superheater is fitted. The steam dome casing is just a dummy, covering the two pop safety

valves; but the sand dome can be made to hold a supply of fine silver-sand, and "drop" sand valves fitted as described in the Live Steam book. Providing the sand is dry when put into the dome, and well sifted, it will flow all right and enable the engine to start a huge load without slipping. Then you'll hear a real American chonk! The fittings on the sloping backhead will be the same as usual, but keep the water gauge vertical by making the top mounting a little longer than the bottom one. The throttle-rod gland should be horizontal. Steam for the donkey pump should be taken from a point as high as possible, as it is not superheated, and must be dry. The pump itself has been fully described in back notes. The feed heater is merely a baby barrel full of little tubes; part of the exhaust steam is shunted through the tubes, and the feed water circulates around them on its way to the boiler check valve, thus mopping up a little heat otherwise wasted. Bell and turbo-generator are of course dummies; but a real bell could be fixed under the tender, same as a real whistle is hidden away underneath. The headlight can be supplied with "juice" from a torch battery in the tender. The engine can be adorned with as many "trimmings" as you care to put on—see any photo of a full-sized American locomotive.

Tender and Details.

The side sills are 13½″ lengths of ⅜″ by ⅜″ by 1/16″ channel brass, "open" sides outwards, the beams being same as engine. Alternatively, use one of Kennion's cast American tender frames. The two trucks are made up something like Fayette's; in fact Fay trucks would do as well as those shown. The booster engine need not be fitted unless especially required, but the coupling-rods and cranks might be added, for appearance sake. The tank is built up from hard-rolled brass or German silver sheet, riveted and soldered, the ends being rounded. A "horse-shoe" coal space is provided, with a sliding gate; and the tank contains the usual emergency hand pump. No brakes need be fitted to the tender; but owing to the "naked" appearance of the works of an American engine, due to the absence of splashers and low running board, the lack of brake gear on the engine itself is noticeable, and for that reason the simple brake shown in the general arrangement sketch will prove well worth the fitting. It can be operated by a little steam cylinder placed horizontally and attached to the drag beam. An injector, preferably of my "Vic" pattern with airball, as described in the Live Steam book, could also be fitted under the trailing end with advantage.

If anybody is especially interested in American "Annie," and wants further details, just sing out and I'll do my best to oblige, and maybe arrange for detailed blue prints.

An Offset Centre for Taper Turning.

By V.W.D.B.

I ONCE had to construct a set of accurate taper spigots and rockets. The lathe I had, although thoroughly accurate and made by a famous firm, had the tailstock provided with a cross slide for turning tapers, but I had made this a fixture, as when once it was used, it was a difficult matter to get it back to turn dead parallel, and owing to the inevitable back lash in the screw, was liable to a slight movement when clamping in position. I therefore constructed the gadget shown in the accompanying drawing.

The body (1) was cast in brass, or rather hard gun metal, and a spare centre that I had by me was threaded and screwed into the back of this, which had been faced, bored and threaded in the lathe.

The taper spigot was then driven lightly into the lathe nose and a light cut taken on the face as far as the two flanges allowed, and then the rest was milled away with a milling attachment mounted on a rising table on the cross slide of the lathe and the two flanges milled, at the same setting, inside and out.

Two pieces of B.D.M.S. were next cut off and soldered into the inside of the flanges. One of these became the slide block (2), the other being discarded.

The gadget was next mounted on an angle bracket and bored for the slide bars (3), which were made of ⅜ in. silver steel. The holes were first drilled with a 23/64 in. drill and then reamered out with a tool makers reamer* made from the same stick of silver steel as that used for the slide bars. The holes in (2) being lapped so that they were a tight sliding fit on the silver steel guide bars.

The M.S. blocks were then removed, and the holes for the adjusting screws (4) bored and tapped to take ⅜ in. 20 threads per in. The reason for choosing this pitch of screw was that a setting dial divided into 50 would indicate thousandths of an inch. This method of setting was not found satisfactory, however,

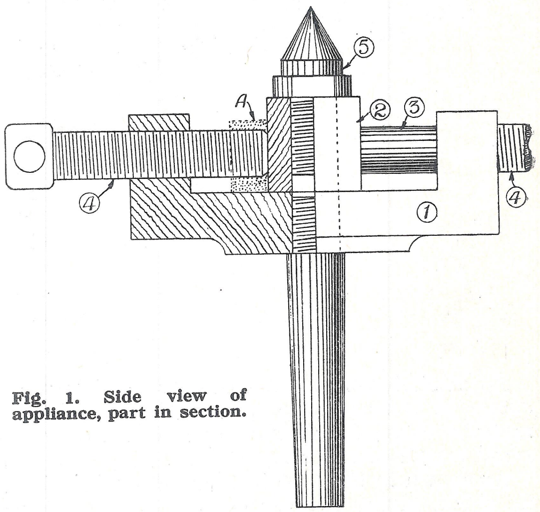


Fig. 1. Side view of appliance, part in section.

* See page 449, Vol. 73, Fig. 4, "Locating holes." Nov. 7, 1935.

for accurate work, and the system subsequently used will be described later.

The gadget was assembled and mounted on the mandrel nose of the headstock, a $\frac{3}{8}$ in. hole bored and tapped, and the centre (5) screwed into place and trued up. The surplus solder was scraped off both the steel and brass, care being taken not to remove anything from the bearing surfaces. When I made this gadget, I did not realise that it would be possible to reset it to cut exactly the same taper, and as it was probable that some more taper spigots inter-

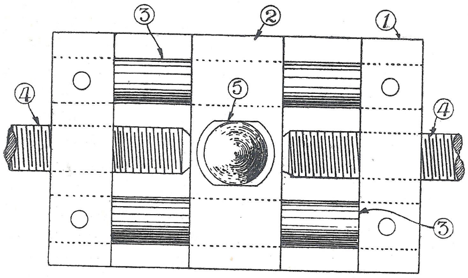


Fig. 2. Front View.

changeable with those already made would be required, I made two of these appliances, intending to leave one permanently set. Now the method of using this gadget is as follows. One of the setting screws is left permanently set and locked with a taper pin through the body. Then a slip piece A is filed, scraped or surface ground to half the amount of taper required. The second adjusting screw is then slacked off and the block inserted as shown between the fixed screw and the sliding centre.

centre line, and to find the true length to cut the bar we shall have to use our friend Pythagoris' theorem again.

Here the hypotenuse is 12 in., and the base x and perpendicular $\frac{x}{40}$

So the offset should be 0.2996 in. instead of 0.3 in.

$$x^2 + \frac{x^2}{40} = 12^2$$
$$1601x^2 = 144 \times 1600$$
$$x = 11.99$$
$$\frac{x}{40} = 0.2996$$

I have sketched in Fig. 3 a cone of 1 in 5, with an enlarged view of the manner in which the centres bear in the countersink centres of the stock bar.

It will be here seen that the problem is further complicated by the bearing points taken by the dead centre and the countersink, both of which are 60°, and the black shading shows how badly they fit.*

From these causes, it is advisable in the first instance to make the adjusting block a trifle on the large size and then to reduce it till the correct taper is found.

I had about 20 of these slip pieces with particulars etched on them in a box, these covered Morse, Smith and Coventry's, and several other tapers, besides which there were several taper reamers corresponding. Internal taper boring, as Mr. H. B. Green points out on p. 225 in the "M.E.," dated September 5th, 1935, is not all beer and skittles, and as he says, it is next door to impossible on an ordinary lathe to obtain anything approaching accuracy.

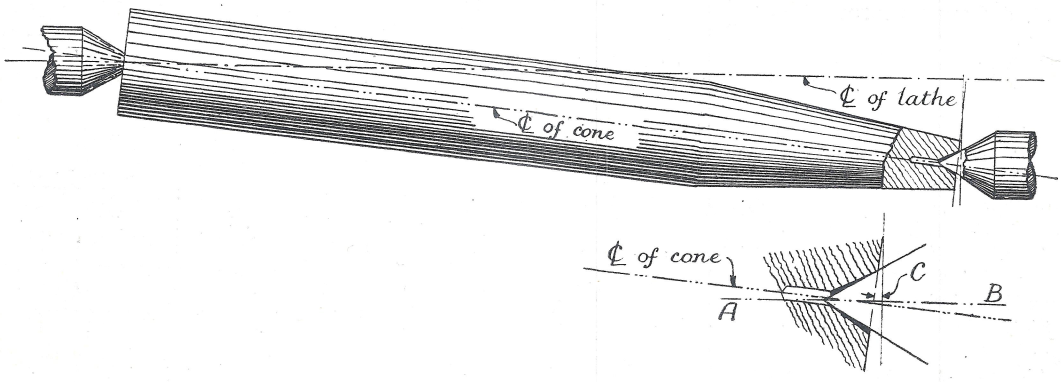


Fig. 3. Application of appliance.

As steel, brass rod and other materials are cheap, it is as well to take a piece of stock material of considerable length, even if only a small length of taper is required.

As shown in the drawing, the block A is 0.3 in. thick, giving a taper of 1 in 20 on a bar 12 in. long.

There is another advantage in having a long piece of stock, beyond the accuracy gained; several tapered spigots can be turned off the same bar.

Even this will not attain dead accuracy, as the length of the taper is measured on the

At any rate, for small diameters, it is much simpler to make a reamer and finish the taper with that, but it is always advisable to bore the cone with a single point tool. For large conical sockets and obtuse angled cones, the top slide of the compound rest must be used, and the method of setting this will be described in a subsequent article, the divisions on the graduated plate being quite inadequate for accurate work.

* A mathematician might calculate the exact offset required, but I fancy that a little correction and adjustment is the easiest and simplest method.

The "101 Combination Utility Vice."

By GEO. GENTRY.

THIS note is the result of our examination of the above useful combination tool, which is a patented article, made by Messrs. The Yorkshire Metal Sprayers, Ltd., of 75, Barrack Road, Leeds, 7. Figs. 1 and 2, taken respectively, show: a front view of the combination, together with the permanently fixed 2-way bench plate to left front, and the clamping screw and bench plank washer, on front right; and a right hand end view, showing operating handle, parallel bench vice, and cutting device, tube jaws, and cable stripper mounted.

The combination includes: a parallel bench vice; pipe vice; tube, rod and strip bender; screwing machine; punching machine; cable, rod and pin cutter; cable stripper, and a flat and conical anvil, with swage socket. Taken in the order given, Fig. 2 shows first the bench vice, which has 3½″ jaws, with hardened steel inset faces, capable of opening to a stop with 3⅛″ of clearance. The screw is entirely covered by the cylindrical guide, which is slotted on the underside to act as a spline to the vice nut as a key. The pipe vice is effected by the attachment of the hardened jaws seen in the front of Fig. 2, which are attached in a manner to be described. By them, tubes ranging from ¼″ to 2″ can be gripped. The tube, rod and strip bending is effected by the cylindrical reel shaped jaw at the base of the moving jaw, which, acting against and opposite to the fixed channel jaw at base of fixed jaw, admits of gripping work between and bending round the cylindrical jaw. The screwing machine is best seen in Fig. 1, which indicates a pair of round rod parallel guide bars, held horizontally between a pair of sockets on the fixed vice body and a pair of similar sockets on an outlying flanged bench support, adjustable for height. The guide bar sockets are all set-screw adjusted in the four positions. The outlying support, still further out, carries a vee tube or rod support capable of adjustment for height. On the guide rods is mounted, adjustable for position anywhere along, a tube or rod vice with fixed and moving jaws by cross action, which vice, mounted on cross vee ways, can be set to centralise, by such floating action, any tube or rod held within its jaws. The capacity of this vice is up to 1⅛″ diameter. Such work, firmly held, and supported at the tail by the vee, is available for hand action screwing by the hollow die carrier, working through the fixed jaw, and operated by the adjustable handle seen better in Fig. 2. The die holder is set concentric with the vice, and on front is hollowed to take 1½″ diameter dies by ⅝″ deep, and the hollow clearance tube is 1⅛″ bore and admits of 2⅝″ forward travel of the die. There is the usual 3-screw adjustment for split circular dies in the holder. The distance from die face to vice centre, with both at extremities, is 6″ nearly enough. It will be seen by this that any round stock or tube up to 1⅛″ about, can be screwed to a length of 2½″ at one vice setting, and can be screwed continuously by successive resetting of the vice. The punching machine is brought into action by the attachment—as will be described—of extra punches and corresponding dies as shown in the outline elevation, Fig. 3. Sheet metal, fibre, brake lining and similar material may be so punched by the action of

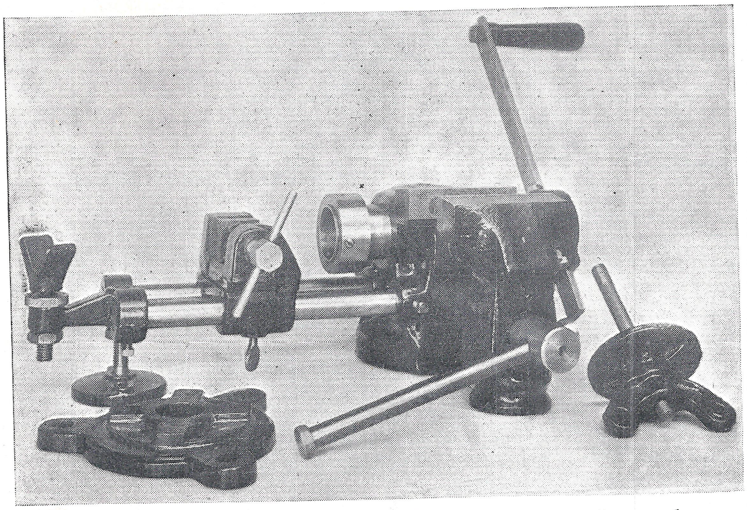


Fig. 1. The "101" Combination Vice, showing Screwing Gear, and attachments to Bench.

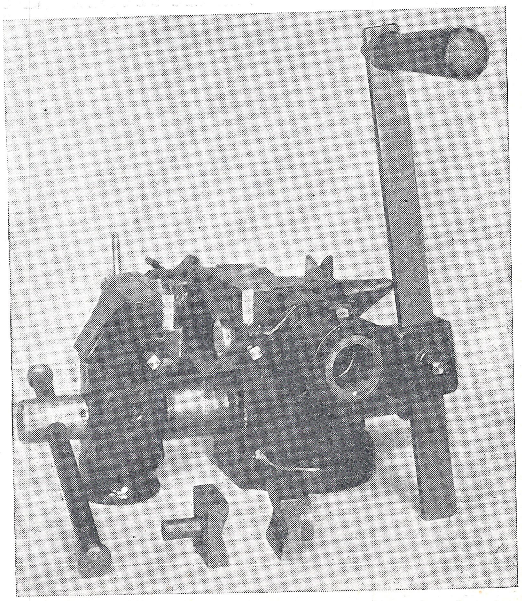


Fig. 2. The "101" Combination Vice, showing Operating Handle, Bench Vice, and attachments, with Anvil.

the parallel vice-screw, but punches and dies are extra. The cable, rod and pin cutter, as seen in position in Fig. 2, and shown in action in Fig. 4, consists of a chisel edge cutter, socketed into the moving jaw below its grip face, to which it is set-screwed, and set opposite a brass anvil block similarly socketed and set screwed to the fixed jaw. The cutter socket is $\frac{7}{16}''$ and takes also, in place of the cutter, a tube grip jaw or a punch. The anvil socket is 1″ and takes also, in place of the anvil, the other tube grip jaw or a punch die. All these actions

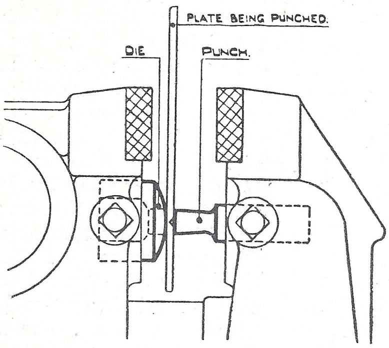


Fig. 3. Showing Punching Gear in position.

are operated by the vice screw. The cable stripper is a vee chisel edged swage piece, set in the swage socket of the anvil, seen in position in Fig. 2. By this, and hand action, insulation of cable can be circularly cut and stripped off. The anvil is a back projection of the fixed vice jaw, and, with any swage removed, presents a $2\frac{1}{2}'' \times 1\frac{1}{4}''$ flat face and a strong conical bick projecting $1\frac{7}{8}''$ further.

By the use of the two way bench plate, the vice can be quickly re-set at a position 90° to its normal bench position, in cases where convenient for some of its operations. The cost of the whole contrivance, as described, minus screwing dies, punching dies or punches, and beautifully finished and painted a royal mail red, is 5 guineas.

Extra to the 2-way bench plate, a similar plate made in one with a bench or table clamp for using the vice portable, on an outdoor or local bench, costs about 13s. 6d. extra, and the contrivance can be supplied as a vice and anvil only, with standard attachments, but without screwing machine, for 31s. 6d. While, if

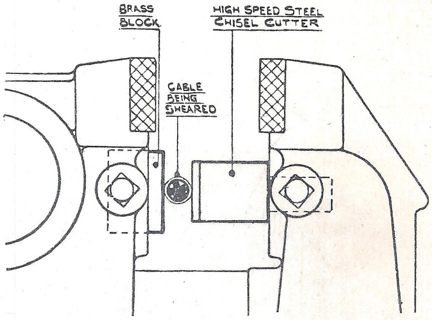


Fig. 4. Showing Cutting Gear in position.

supplied as a screwing machine, without vice, it costs £3 17s. 6d., minus screwing dies. In either form, for continuous screwing purposes, a drip pot, attachable by clamp to the guides, is available, but this is an extra, of price not given.

The workmanship of this handy tool is above the average, and the finish and durability of its hardened working and cutting parts, marks it as a regular workshop and trade used tool of a high class order, and quite cheap as quoted.

Imitation Studs for Models.

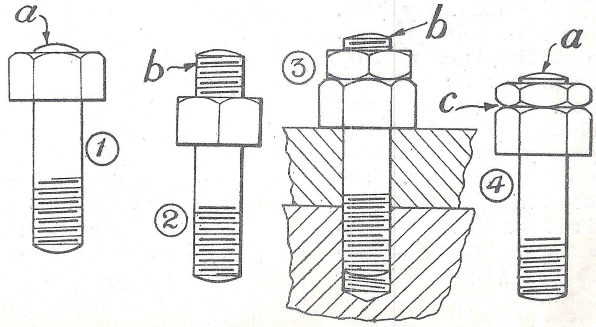
Model makers frequently comment on the difficulties attendant on the fitting of small studs in models.

For those who are content to have a model of correct appearance, but having faked details, the imitation studs illustrated herewith may be used. These imitation studs are as easily fitted as set screws.

Referring to (1) the "stud" is turned in one with its "nut," that is, the stud is actually a set screw with a slight rounded projection *a*, in imitation of the end of a stud, projecting a little beyond a nut. The "stud" is merely screwed home with a spanner, as is an ordinary set screw, but when in position, is of similar appearance to a nut on the end of a stud.

If studs are to have lock-nuts, they can be made as shown in (2). In this form, two screw-threaded portions are provided, one of which is screwed into the job as described above. A lock-nut is afterwards screwed on to the other screw-threaded portion *b*, the underside of the lock-nut being slightly countersunk to ensure its seating on the head or "nut" of the stud. The assembly is shown in (3).

Another form is shown in (4). Here the "stud" and the two "nuts" are integral, all being turned from one piece of hexagonal material. A groove is turned at *c* to represent a chamfer on each "nut," and a projection is made at *a*.



Examples of imitation studs.

R.H.

The Production of Platinised Mirrors, and the Soldering of Metals to Glass.

By A. J. ANSLEY.

REFLECTORS are usually made of metal or glass, the metal being highly polished by means of a buff and polishing powder, and that of glass by depositing a reflecting surface upon the material by an electrical or chemical process. The essential properties of such a deposited surface should be that of good mechanical strength, and an even reflecting surface, coupled with a high value of reflectivity. Mirrors possessing such qualities find wide application in many industries and sciences, being used in electrical and measuring instruments, television apparatus, etc. The latest development in the manufacture of mirrors makes use of the fact that metals can be deposited upon receiving surfaces under vacuum with the passage of an electric discharge. While this method undoubtedly produces the best possible mirrors, the high cost of the evacuating pumps and associated apparatus places it beyond the reach of most workers. Excellent mirrors may be produced by chemical means, utilising the chemical reactions of silver nitrate and platinic chloride in solution form. While the results yielded by the silver nitrate and the method is well known, that of the platinic chloride method deserves greater popularity. Such reflecters made by this means give better grained surfaces, of finer texture and higher reflectivity values, than with the silver nitrate, and by the further application of the method, metals may be soldered to glass. Moreover, the technique involved being of a much more simple nature, it should have precedence over the more commonly employed method. The materials are cheap, and may be obtained from any chemist; they are platinic chloride, oil of rosemary and oil of lavender-flowers. Platinic chloride is very hygroscopic, i.e. it readily absorbs moisture. For this reason, when purchasing the same from the chemist, he should be asked to thoroughly dry it and place in a bottle, the cork of which is sealed by means of molten paraffin wax. Furthermore, the bottle should not be opened until it is desired to use the chemical, and resealed immediately after use.

An amount of oil of rosemary, about twice as great by volume as the platinic chloride, is then poured on, and the chloride mixed with the oil until no lumps are left, and the resulting mass is black, and about the consistency of thick paint. It is then allowed to stand for about one hour. At this point, one of two courses may be taken, according whether the solution is to be used for preparing glass to receive solder, or whether the finest mirrors are to be produced. If the former is desired, a quantity of oil of lavender, about three times as great by volume as the compound already prepared, is added and thoroughly mixed. The solution is then ready to apply.

Suppose then a glass tube is to be prepared to receive a coat of solder. The tube should be warmed, so that the oily solution will spread freely, the tube dipped into the liquid, held in a vertical position, and the surplus oil allowed to drain off. The tube is then rotated so as to spread the film on the glass as uniformly as possible, at the same time passing it backward and forwards in the flame. At a temperature of 200°C., the surface will become glossy and jet black; if, however, the temperature is raised still further to 320°C., the black coat will change into a brilliant mirror. If a very adhesive coat is required, heat to a still higher temperature. After such preparation, a tube can be soldered as if it were solid platinum, but care must be taken to ensure that the film is not kept hot for too long a period.

If a more refined solution is required, the black mass formed by the oil and the platinic chloride is poured into a bottle, alcohol added, and the whole well shaken. After a short period, the supernatant liquid is poured off, and a mass of yellow crystals will appear. The crystals are then dissolved in oil of lavender, the amount depending upon the concentration required. For mirrors, the proportions will be of the order 25 parts of oil to one part of platinic chloride, by weight.

The solution prepared as described may be now applied to the surface, which is desired to be coated with platinum. A very thin film of the solution will give a brighter mirror than a thicker layer. If the solution is too concentrated (in which case more Oil of Lavender should be added) or is applied too heavily, the film produced will be grey, opalescent or black, but can be burnished by means of a cloth.

If all the conditions are fulfilled, a mirror of incomparable brightness will be formed. In order to make the coat adhesive, the glass surface must be heated to barely perceptible redness for ordinary glass. Further heating will cause cracking of the surface. If it is desired to produce a very thick film, a number of coats may be put on, the brilliancy is still maintained, the multiple coat behaves as a single film, and is as adhesive as the first one applied. When properly applied, the film is mechanically an integral part of the glass. Various materials can thus be platinised and made to act as reflectors, such as glass, quartz, mica, or any other material which will not fuse, decompose or react chemically with the platinising solution at a temperature of 300°C. Metals such as platinum and pure nickel, which do not oxidise or react with the solution at this temperature, will produce excellent mirrors, the coats of which cannot be rubbed off.

Unfortunately, however, in the case of such vitreous materials, the film will not be strongly

adhesive unless the material can be heated until it becomes plastic. Thus, for quartz and unglazed porcelain, it cannot be made strongly adhesive, because the platinum film will have evaporated by the time the high temperature at which quartz and porcelain becomes viscous is reached. The best mirrors are produced when the flame is played directly on the surface treated with the solution. If the surface to be platinised is inaccessible to a direct flame, as in the case of the interior of a vessel, a stream of very hot air is made to play upon the interior surface, producing a film as good as in the former case.

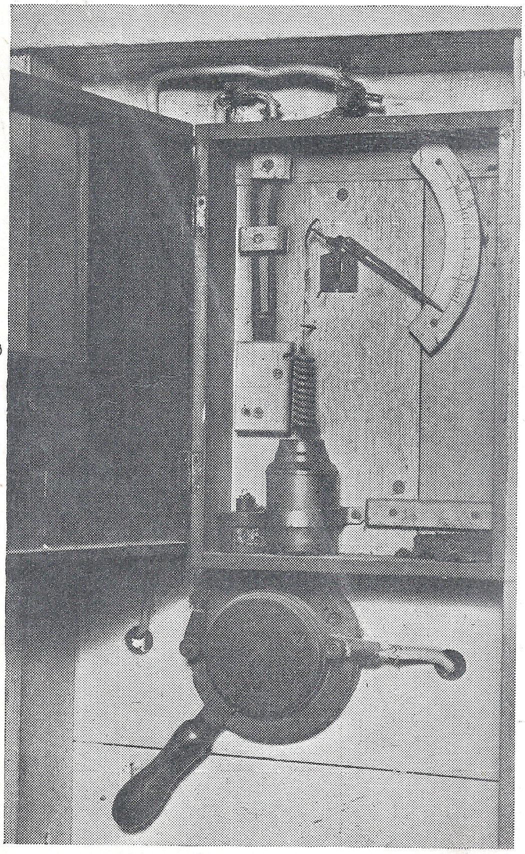
The Oldest Working Dynamo?

THE Crompton generator shown in the adjacent illustration may well be the oldest dynamo still in regular use in this, and perhaps any other country. It is installed at Sulham Rectory, near Pangbourne, Berks., and charges the accumulators for lighting the 18-roomed rectory and outbuildings.

Owing to the fire which burned down the Crompton works at Chelmsford in 1895 and destroyed the records of early machines, it is impossible to date the dynamo exactly, but from the evidence of the machine number and the design, it can be said with certainty that it was built before 1888, probably in 1885.

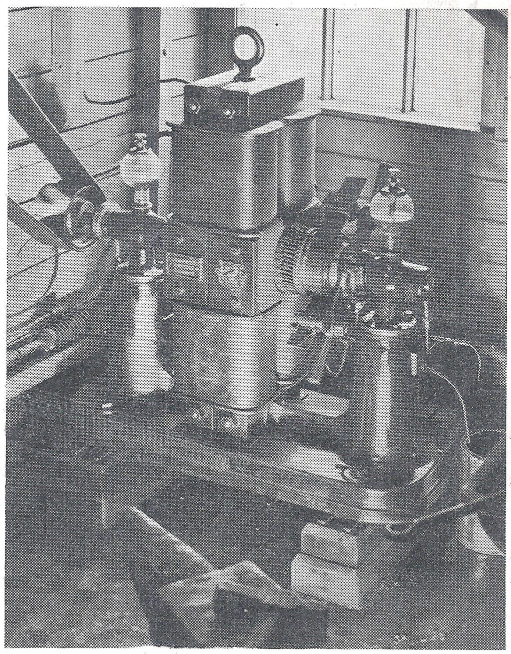
That is to say, it is fifty years old. It has been in regular use throughout its life and is at present run for anything up to five or six hours each day except Sunday.

The Rev. H. C. Wilder, who lives in the rectory, and by whose kindness the photographs were obtained, was able to supply some further information.



The Ammeter and Main Switch.

The electric lighting plant was installed at the rectory by Mr. Wilder's brother, who was a pupil of Col. Crompton. He was responsible also for the remarkable instrument (which apparently still gives satisfactory readings) and switch illustrated in the second photograph. This shows clearly the construction of the curious solenoid type ammeter. The inkbottle-like receptacle at the bottom contains oil which acts as a damping medium to reduce the vibrations of the pointer. Immediately below the instrument case is the main switch.



The old Crompton Dynamo.

The dynamo, which is marked $5\frac{1}{2} \times 10$, indicating the dimensions of the armature core, is driven by a belt from a comparatively modern Petter oil engine, which was installed in place of an ancient machine with naked flame ignition provided by a spirit lamp.

The dynamo occasionally betrays its age by exhibiting little eccentricities, which is not altogether surprising. The lubrication system is hardly what it was, the oil having a tendency to run through the bearings too fast; and the commutator has been known to come adrift.

But taking it all round, the old machine, after fifty years, still puts up an astonishingly good performance, worthy of the name it bears; and it looks fit for another spell of service, in spite of its age.

QUERIES and REPLIES

6,866.—Connections of Lucas Magdyno.—R.McC. (Ireland).

Q.—Could you please give me the connections of the Lucas Magdyno, particularly as to the connections from brushes to the external circuit?

A.—A full description of the Lucas Magdyno appeared in "Automobile Electricity" for 1930 (September issue), to which perhaps you could refer, and incidentally, to save the space otherwise required by publishing a connection diagram of not very general interest. The connections from the brushes are quite simple; the negative brush is earthed to the frame, while the positive brush is connected with one end of the thick series winding on the cutout, which terminates in one of the contact points in the main charging circuit. The connection from the other contact point goes direct to the positive terminal of the battery.

6,834.—Autogiro Transmission.—L. McD. (Dunfermline).

Q.—In a recent argument between two motor engineers, the subject was autogiro transmission; I was merely a listener to this debate, but was highly interested. One of them stated that it was possible for an autogiro to rise perpendicularly from a marked area of small dimensions, and to descend on the same spot, the motive power for the vertical ascent being supplied from the horizontal rotor, which he stated was driven by a motor.

The other positively declared that the usual propeller in the nose of the plane was driven in the usual manner, but the other rotor, the 3 bladed one, was not; he stated that it merely turns on a pivot, and that its action is merely to turn and so help to retard the descending effect of the plane. Another type, he says, is driven by the effect of the draught from the propeller turning the rotor; is this possible? Also, is it possible for one of these machines to descend and ascend vertically on a certain area, and what, if any, is the nature of the motive power supplied to the lifting rotor? I have been informed of a wingless type of autogiro which can ascend vertically; is this correct?

A.—An autogiro is a unique type of aircraft in which the lifting force is derived, either partially or entirely, from rotating aerofoils, which are not mechanically driven from the engine. They actually constitute a form of windmill, driven by the air thrown back by the propeller situated and driven in the normal way by the engine, but the lifting principle is essentially the same as in other types of aircraft, except that as the aerofoils are in motion, the craft is not so dependent upon forward motion to maintain lift and control. As a result, the autogiro does not readily stall, and may descend under proper control at a much steeper angle than a normal aeroplane; under certain circumstances, almost vertical descent is possible. It cannot, however, ascend vertically, and its rate of climb depends, like other aircraft, upon its power and loading.

In the wingless type of autogiro, the distinctive feature is that control is obtained by moving the shaft carrying the rotor blades, so that the incidence of the rotor relative to the machine is altered. This dispenses with the need for elevators and ailerons. In this type of machine, a starting device to set the rotor initially in motion, driven from the engine, is employed; but this is disconnected in flight, and is in no sense of the term a power drive.

6,848.—Construction of Dry Rectifiers.—G.Ltd. (Coventry).

Q.—We are desirous of carrying out some experimental work in connection with dry metal rectification. Can you give us any information as to the theory and construction of metal rectifiers of the copper-oxide type, or refer us to any literature on the subject?

A.—A brief description of the construction of copper-oxide metal rectifiers of the "dry" type, as well as of chemical rectifiers and valve rectifiers, is to be found in the MODEL ENGINEER Handbook "Small Transformers" (No. 53). A more extended discussion as to the theory and behaviour of these instruments appears in "Alternating Current Rectification and Allied Problems," by L. B. W. Jolley, M.A., M.I.E.E., of the General Electric Co.'s technical research staff, published by Chapman and Hall at 30s. Beyond this, there would appear to be very little useful literature except occasional references in the scientific journals, and so far as practical construction is concerned, we are afraid you will find nothing at all serviceable has been published. The preparation of a suitable surface to the copper-oxide elements is a matter of some delicacy, involving a great number of different processes, and since the manufacture of copper-oxide rectifiers is in the hands of so few firms, it is practically impossible to obtain any useful information as to commercial methods of manufacture.

6,845.—Building a Model "Skimmer."—H.R.P. (Dursley).

Q.—I wish to build a model Skimmer with a beam of 20″ and length 4′, powered by a 98 c.c. 1 h,p. Villiers Motor cycle engine. What size propeller and what pitch should I require, also the speed I am likely to obtain, the total weight being not more than 28 lbs.?

A.—It is impossible to give you any definite data regarding your model "skimmer" (we presume this to mean a hydroplane) as it appears to be a purely experimental venture, and there is little, if any, experience of craft of similar size and power available. We suggest trying a propeller about 4½ in. diameter by 9 in. pitch. If the hull is of reasonably good design, and weight distribution correct, you might obtain 30 m.p.h. or more, but we doubt if such a performance could be attained without considerable experiment with various details of hull and power plant.

PRACTICAL LETTERS *from* OUR READERS

The Engines of the "Wyoming."

DEAR SIR,—My attention has been called to an article in your valuable little journal under the heading "Some Reminiscences concerning the Engines of the S.S. 'Dakota,'" and I thought it might interest your readers if I gave particulars of the engines of the Guion Mail S.S. "Wyoming," on which vessel I served as a junior engineer officer.

I joined the Guion Line shore staff early in 1883, and after a month's service ashore was appointed 8th engineer of the "Wyoming," rising to 5th before I left the Line to join the MacIver Liner "Europa."

"Old Millwright" states that the "Dakota" was the first steamer to take a large compound engine across the Atlantic; I do not know the date of her building, but if it was 1871, as mentioned in the last paragraph of his article, she certainly was not entitled to the credit of doing so. I think the date of her "birth" was earlier, because the "Wyoming," one of Guion's "Brigs," was built in 1870, and also I believe her sister ship, the "Wisconsin," was built that year or the following.

The "Wyoming" was built at Palmer's of Jarrow, her registered tonnage being 3,238. Her main dimensions were 366.2 ft. × 43.2 beam × 26.8 moulded depth. She was brig-rigged, as also were the "Wisconsin," "Dakota," "Montana," and "Nebraska." The R.M. Steamships "Arizona" and "Alaska," the first "Greyhounds" of the Atlantic, had four masts, two being square rigged and two fore and aft rigged.

The "Wyoming's" engines could be described as "vertical, horizontal, trunk and single crank, direct acting." H.P. engine (vertical) cylinder was 60″ diameter, with two connecting rods working off a long crosshead. The L.P. engine (horizontal) on the port side of the engine room was 120″ diameter, piston connected to a trunk 44″ external diameter, which passed through each end of the cylinder. The connecting rod worked from a gudgeon pin in the centre of the trunk on to the middle portion of the crank pin, between the two vertical H.P. connecting rod bottom ends. The crank pin was 3 ft. 6 in. long × 3 ft. 6 in. stroke.

The air and circulating pumps were driven horizontally from the L.P. piston, the rods passing through stuffing boxes in the L.P. cover on either side of the huge stuffing box, through which the trunk passed. The valves were the Corliss type, two exhaust and two steam valves worked off discs, in case of both cylinders, driven radially from the disc or "wrist plate," which was actuated from ordinary link motion through a rocking shaft.

The main boilers were two in number, each 16 ft. 6 in. diameter × 23 ft. long; shell plates $1\frac{1}{4}''$ thick of Low Moor iron. Each boiler had ten furnaces, five at each end, all opening into one huge combustion chamber. These were the largest marine boilers of the Scotch type ever built; the working pressure was 70 lbs. In addition, there were two single-ended auxiliary boilers, Scotch type, three furnaces each, which were used along with the main boilers at sea, and in harbour as cargo boilers

The consumption of this "plant" was 69 to 75 tons per day, horse power 2,532, giving a little over $2\frac{1}{2}$ lbs. of coal per I.H.P. per hour. Speed 13.45 knots. The two sisters, "Wyoming" and "Wisconsin," were very successful vessels for many years, and ran with the original engines and boilers until broken up in 1894.

My experience of the "Wyoming" was that she was a magnificent sea-boat. During the terrible hurricane of March, 1883, when she was struck by a so-called tidal wave, which played havoc with her lifeboats, smashing up six out of eight, and twisting up her five-inch davits like wire—she behaved splendidly. I sailed in many ships during the '80's and early '90's in all the seven seas, but never in a better sea-boat than the old "Wyoming."

Yours faithfully,

Grimsby. WALT. J. WOOD.

The Canadian "Switcher."

DEAR SIR,—Mr. S. F. Plumbley's picture of an old balloon-stack 0-4-4T. loco. has been tentatively identified.

Mr. Robert R. Brown, Secretary, secured for me from Mr. W. M. Spriggs, Vice-President of the Canadian Railroad Historical Association, Montreal, the following information regarding a group of eight locos. supplied to the old Great Western Railway (of Canada), now the Canadian National Toronto-Brantford-London and Windsor and Toronto-Hamilton-Niagara Falls main lines, by the Globe Locomotive Works, Boston, Mass.:

0-4-0 Tender type switching engines, cylinders 15″ × 20″ or 22″, drivers 56″ or 60″, broad gauge (5′ 6″). Fuel, wood.

Original No.	Re-numbered.	Original Name.	Date placed in service.
7	86	"Ontario"	Sept. 1853
8	87	"Erie"	Sept. 1853
9	88	"Superior"	Oct., 1853
10	89	"Michigan"	Feb., 1854
11	90	"St. Lawrence"	Nov., 1853
12	91	"St. Clair"	Oct., 1853
13	92	"Huron"	Oct., 1853
14	93	"Simcoe"	Feb., 1854

When the G.W.R. was changed to standard gauge in the early 80's, these engines were rebuilt into 0-4-4T., and apparently re-named at same time. It is known that the "Huron," No. 92, was re-named "Gilson Homan," and if the number of Mr. Plumbley's engine is 88, it was quite evidently "Superior" of above list, They were all broken up years ago.

As the Globe Works was known to be up to the times regarding valve gear, these engines most probably had link motion ; loose eccentric and Croton V-hook motions would have been out of date by 1853. The eccentric crank is, of course, for boiler feed pump drive only. Globe also featured the circular valve chest, but it is not certain whether valves were round of not.

Cylinder lubricant was tallow, applied through the funnel-shaped gadget on top of steam chest by the engineman, after climbing out along the running board. As this had to be done while engine was coasting with steam shut off, it will be seen that, Canadian winter weather being what it is, the arrangement was hardly satisfactory to the enginemen !

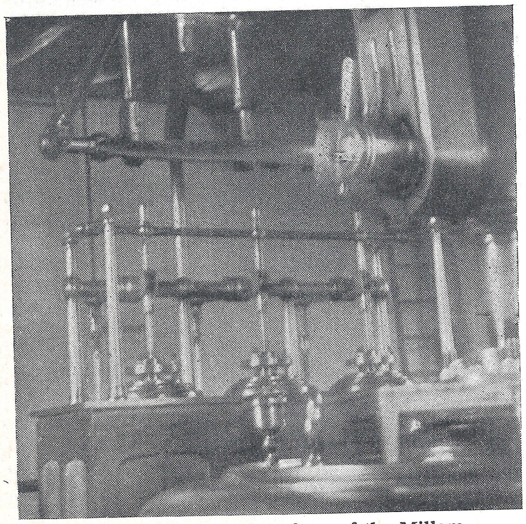
Mr. Brown suggests that, if further information is desired on these engines, Mr. Spriggs be communicated with, his address being P.O. Box 111, Ste. Anne de Bellevue, Que., Canada. Trusting that the above will be of interest to Mr. Plumbley and Captain Alston, I remain,

Yours truly,

Stratford, Ont. H. S. Gowan.

Cornish Pumps.

Dear Sir,—Referring to the enquiry of Mr. Woodall in your issue of November 14th, the Hodbarrow Mining Company, Ltd., of Millom, Cumberland, have three Cornish engines. Two of these are in continuous operation. They were constructed respectively in 1868, 1876 and 1899, and are 70″ × 120″ stroke on the cylinder and 9 foot stroke on the pump. All are by the late firm of Harvey and Co., of Hayle, Cornwall. The balance beam of the 1876 engine, which was of wood, was later replaced with a C.I. beam by Holman Brothers,

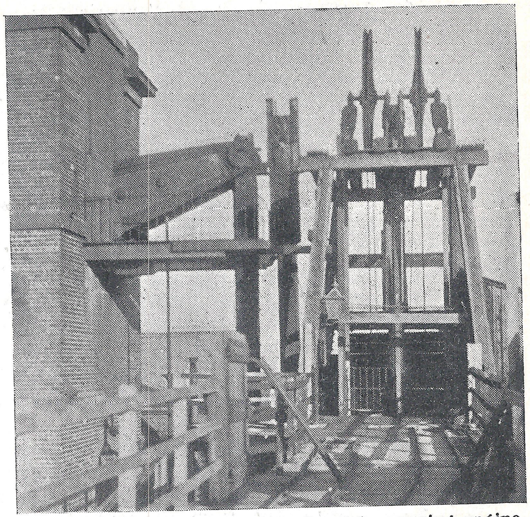


The parallel motion of one of the Millom pumping engines.

who are, of course, still in existence, and took over the goodwill of Harvey's.

The normal economical speed of these engines is 4–5 strokes a minute. They can be " revved up " to 11 strokes a minute in a case of dire emergency.

There is also a very interesting winding engine in the same plant, by Walker Brothers, of Wigan. This has four separate valves per cylinder, the valve spindles standing vertical in a row. The reversing link is straight



External view of a 70″ by 120″ Cornish pumping engine at Millom, Cumberland.

slotted. I enclose an internal and external snap of the 1876 pump (taken in between strokes).

Yours faithfully,

Ambleside. C. S. Cowper-Essex.

Old Cornish Engines.

Dear Sir,—I was glad to see " Cousin Jack's " letter on the subject of old engines.

I myself took a photograph of the engine Mr. Cole describes, at Carn Brea (" Bree " is the printer's spelling, not mine ; also he recently rendered my " Lilleshall " into " Littleshall "). None of the Carn Brea engines is by Holman. I don't think there is a beam winder left at East Pool.

The 144″ engine (singular) mentioned by " Cousin Jack " was a joint effort of Harvey and the Perran Foundry, for Haarlem Mere Drainage ; the big cylinder was an annular low pressure, as it was a compound job. The biggest engines at the Severn Tunnel are 80″ or 90″, I forget which ; the engines there, in the main station at least, are all Harvey's.

What is the " correct " method of describing the strokes of Cornish engines ? The use of inches may have been a local custom, but Harvey's refer to " 100″ bore and 11′ stroke," etc., the Metropolitan Water Board use feet, and Cornish blowing engines (e.g., Eglinton iron works) have their strokes given in feet.

Could " Cousin Jack " or any other correspondent give me any information on the Cornish side-lever pumping engine ? I am trying to find out where and when these engines were used, and should be glad of some information.

Yours truly,

Harrow-on-the-Hill. W. Melville.

Institutions and Societies.

The Society of Model and Experimental Engineers.

Meetings, at Caxton Hall, Westminster, at 7.0 p.m.

Thursday, January 23rd. Competition, Track and Model Night. More locomotives and models, please. Special prize offered.

President's prize. Mr. T. N. Gilbert, our President for this year, has not only put up prizes for a competition such as has been held during the past year, but has also offered a prize to be awarded on each C.T. and M. Night for the best display of work on that evening. The *only* restriction is that work gaining an award is not eligible for subsequent competitions in this series. The *only* restriction for the major competition is that work having already been awarded a President's prize is not eligible, but even such work may be entered again, though only the portion added since the award will be taken into consideration.

Entry forms for the major competition are in course of preparation. Members are asked to apply for same as soon as possible. In the event of a member desiring to alter or amend his entry later, no obstacles will be placed in his way. Therefore, make your entry as soon as possible, please, so that a good display may be assured.

Secretary, R. W. Wright, 202, Lavender Hill, Enfield, Middlesex.

Croydon Society of Model Engineers.

A general meeting will be held on January 13th, at 8 p.m., at Clyde Hall, Clyde Road, Addiscombe; will all members please make a note of this?

Hon. Sec., H. W. Clements, "Olivedeen," Coulsdon Road, Old Coulsdon.

The Aylesbury Gang.

Next meeting will be held at 7.30 p.m., Friday, January 3rd, at the First and Last Hotel, Dunstable. The annual dinner of the Gang will be held at 7.30 p.m. on Saturday, January 11th, at the same address.

All communications to H. D. Bond, Park Square, Luton.

The Junior Institution of Engineers.

Friday, January 3rd, 1936. At 39, Victoria Street, S.W.1, at 7.30 p.m. Informal meeting. Discussion of the Prevention of Noise from Engineering Plant. To be opened by D. W. McJannet.

Friday, January 10th, 1936. At 39, Victoria Street, S.W.1, at 7.30 p.m. Ordinary meeting, Paper: "Refractory Materials." by Dr. J. H. Partridge, M.I. and S.I., M.Inst.Met. Slides.

The Manchester Society of Model and Experimental Engineers.

The next meeting of the above Society will be on Friday, January 10th, 1936, at 8 o'clock, at the Manchester Schools of Technology, Sackville Street, when Mr. Stevens will give a further talk on his Loco. Testing apparatus.

Hon. Sec. and Treas., W. E. Wood, 20, Albert Place, Longsight, Manchester, 13.

Leicester Society of Model Engineers.

The next meeting of the above society will be held on Friday, January 10th, at 8 p.m., at St. Mary's Schools, Castle Street.

Hon. Sec., J. Walker, 78, Waltham Avenue, Braunstone Estate, Leicester.

Hartlepools Sailing and Steam Model Yacht Club.

A very pleasant evening was enjoyed by the members of the above Club on the occasion of their 34th annual meeting, which combined a supper and social evening. Mr. K. McD. Cameron, who has for many years been President of the Club, occupied the chair. The Secretary, Mr. J. J. Brown, presented the financial and other reports, which were accepted as entirely satisfactory. The various cups and prizes were presented by the President who, in the course of his remarks, made mention of the solid and pleasing manner in which the Club had managed its affairs, and emphasised the need for new members.

The cup winners were as follows:—G. Lovett (Motor *Boy Peter*), first prize; J. Larren (Motor *Eagle*), second prize and "Cappleman" cup; J. J. Brown (Steam *Lily*), third prize. G. Loe (Steam *Albert*) won the "Strover" cup and "Purdon" cup; L. Strover (Steam *Charlie Lindsay*) won the Lamb cup.

Hon. Sec., J. J. Brown, 126, Alma Street, West Hartlepool.

Notices.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. Unless remuneration is specially asked for, it will be assumed that the contribution is offered in the general interest. All MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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Contents.

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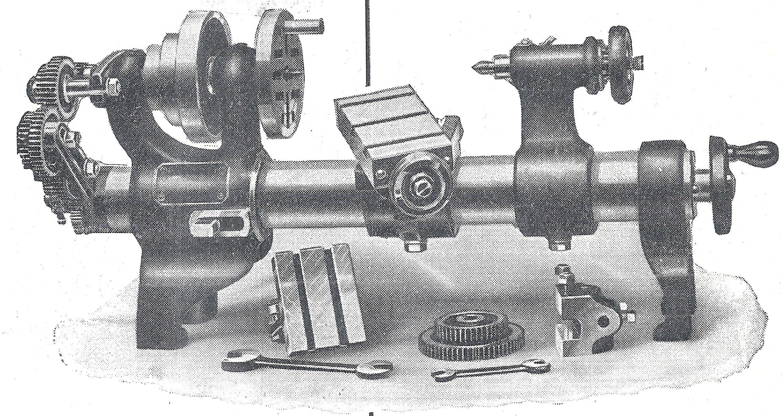

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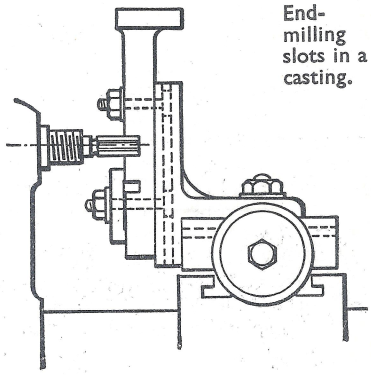
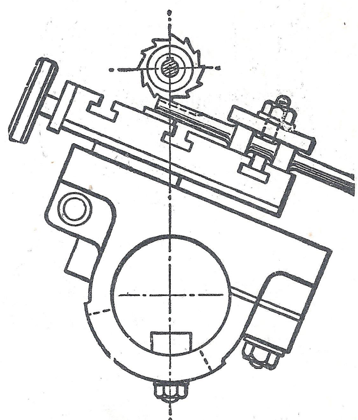
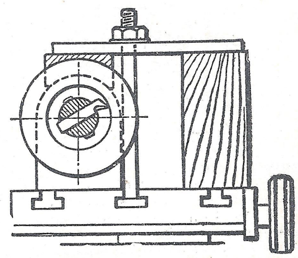


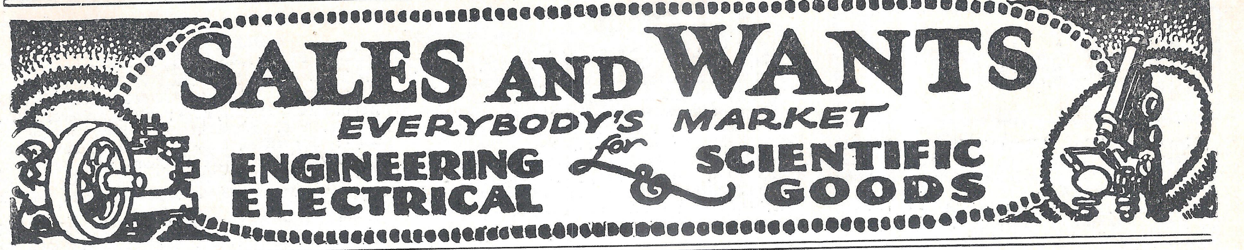
End-milling slots in a casting.



Milling keyway in crankshaft.



Boring cylinder of model steam engine.



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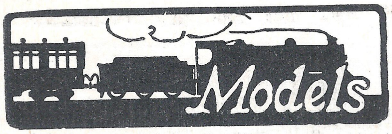

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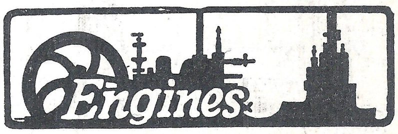

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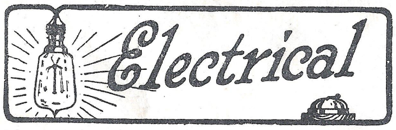

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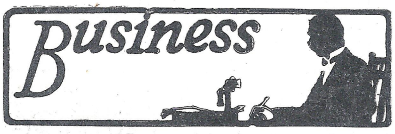

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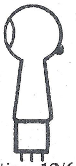

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January 29th—P. M. A. L. Annual Dance and Exhibition of Models at The Farnan Hall, Streatham, 7 p.m. to 12.

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